TORQUAY CONVENTION

ELECTRICAL REVIEW

FRIDAY
29 MAY 1959

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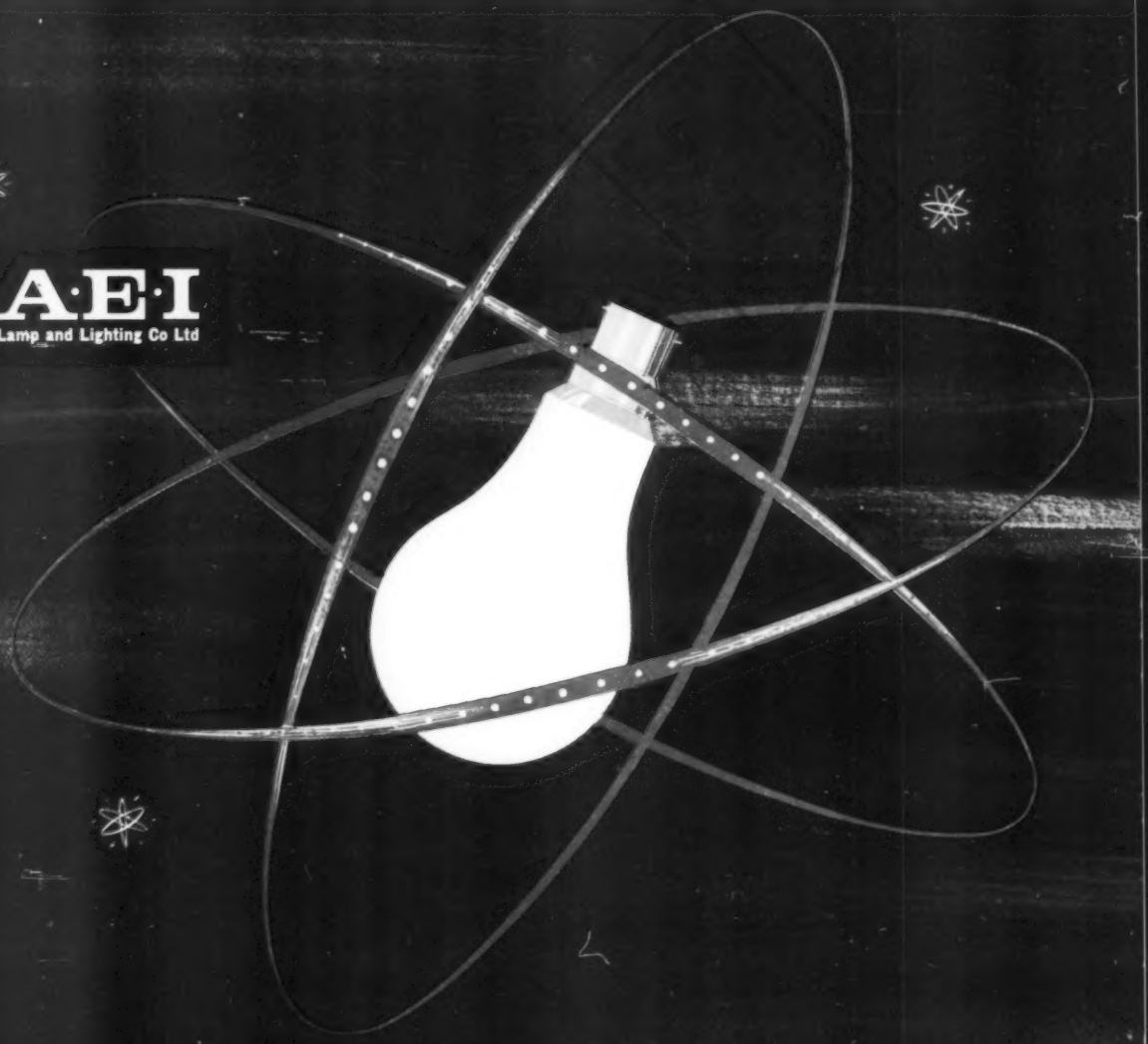

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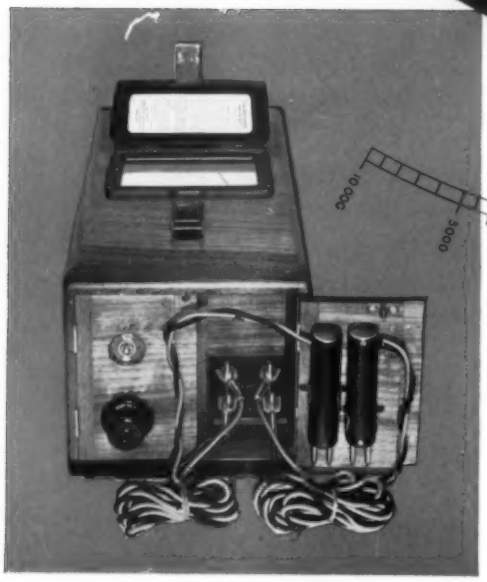
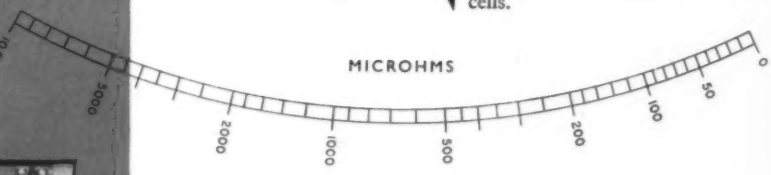


In the battery model, this compartment contains 2 alkaline cells.



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ELECTRICAL REVIEW

29 May 1959 Vol. 164 No. 22 Established 1872

Electricity's Contribution

THE eleventh British Electrical Power Convention which opens at Torquay on Monday next has for its theme " Electricity—Its Contribution to the Standard of Living " and no theme could be more apt to the present day. Parties contend over the distribution of the national product but ultimately the standard of living depends upon the size of what has to be distributed—the total volume of goods and services produced each year—and this total depends largely, if not mainly, on the use of electricity. The householder may think primarily of services, and for him—or her—a world in which there was no electric light or radio, no cinemas or telephones, no car batteries, vacuum cleaners or deaf aids, would represent a very low standard of living indeed. But electricity is just as essential in the production of goods as of services, and in that process of mechanisation which has so enormously multiplied the productivity of labour.

The Convention Council has arranged an interesting, and not too formidable, programme of technical papers, in addition to the usual social fixtures and the exhibition of equipment. But the Convention is more than just a series of meetings: official, technical, social and individual. It is the one occasion in the year when all sections of the industry, supply, manufacturing and contracting alike, can get together and take a look at their common problems in the friendly atmosphere of a seaside town.

But notwithstanding its many-sidedness the Convention, like its I.M.E.A. predecessor, is still dominated by the supply industry. How stands that industry today after eleven years of nationalisation? Politically and financially the omens are favourable: no new legislation is threatened and the brakes have been taken off capital investment. What is needed now is a measure of the drive and enthusiasm of the early pioneers of the industry, particularly in those branches which lack the stimulus of rapid technological development. On the generation side the nuclear programme is recapturing something of this early enthusiasm but the progress of the conventional station, with its gradual raising of temperatures and pressures, can hardly expect to be so spectacular or so attractive to the scientific entrant. The distribution side is also relatively lacking in glamour, and,

as Mr. D. J. Bolton points out on page 995, in recent years it has been relatively starved of capital. Perhaps one lesson which the Convention will bring out is the essential unity of the supply industry which must aim at the highest possible technical efficiency in every link in the chain from station to consumer.

COLLEGE OF TECHNOLOGISTS

Last November, the National Council for Technological Awards decided to create a higher award than the Diploma in Technology. This new award will take the form of membership of the College of Technologists (M.C.T.), the establishment of which was announced last week by the governing body of the Council. The College of Technologists will operate within the framework of the National Council for Technological Awards and will be served by the same administrative staff. A Board of Scientific and Industrial Studies is to be responsible for the academic and industrial aspects of the administration of the award. The governing body of the National Council has met as the Court of the College and appointments to the Board have been made.

It is to be hoped that the M.C.T. award will serve a useful purpose and that many people will desire to qualify. Because it is tied to industrial experience and is not merely an academic qualification, it may be difficult, however, to persuade students (or employers) to accept the idea that it is of equal standing to the Ph.D. degree, which, of course, can be awarded only by universities.

ELECTRICALLY EQUIPPED GREENHOUSE

A short description appears in this issue of a greenhouse which won a second prize in the scientific section at an international flower show recently held in Paris. The greenhouse is fully automatic and extensive use has been made of electrical equipment in providing artificially the most beneficial environment required to stimulate plant growth. Soil and air warming is carried out by main and low voltage cables, the air temperature being given the 10 deg F fall during the night shown by experience to be desirable, and electrical control is employed for the various methods of watering used.

One particular feature incorporated in the greenhouse and not yet in general use but which, it is thought, will undoubtedly appeal to many gardeners and commercial growers in the future, is an enclosed "growing cabinet," also equipped with means to provide an artificial environment. By regulating the day length and temperature in the cabinet, plants can be grown and flowered at any time of the year irrespective of the season. The greenhouse has been on view this week at the Chelsea Flower Show in London and during the summer it will be seen at a number of other shows.

UNDERGROUND GASIFICATION

The underground gasification experiments which are being conducted at Newman Spinney, near Chesterfield, are to finish at the end of next month despite the fact that a successful 3·75 MW power station has been put into operation. As originally planned, this pilot plant, a description of which appears on page 987, was to have been operated for a period of not less than two years. It was intended that it should be followed by a commercial station designed for an output of at least 60 MW. Although the work has not been carried to its planned conclusion, certain deductions can already be made.

The economic and technical results of underground gasification improve considerably with increasing thickness of seam. It has long been known that the seams at Newman Spinney were on the lower margin of thickness. Even with such thin seams it would appear that gas can be produced at a cost not exceeding 3d per therm. This cost would be greatly reduced where thicker seams are available, and there exist several possible applications overseas in countries where conditions are favourable. The purpose of the National Coal Board project was to produce gas from seams which would not otherwise have been mined. Meanwhile, certain positive advances have been made through the British project, notably in the techniques of directed drilling, which are likely to have valuable applications in other fields.

THE CONVENTION PRESIDENT

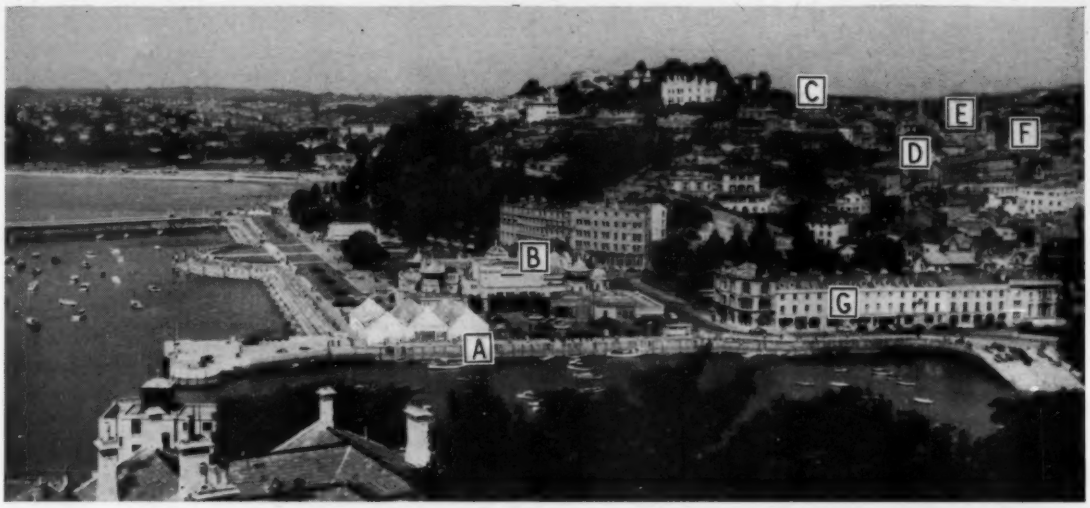
ON the opposite page we reproduce a specially-commissioned pencil sketch of **Mr. C. R. King** who is presiding at the eleventh British Electrical Power Convention at Torquay next week. His activities in many directions have made Mr. King very well known throughout the industry. He joined the Derbyshire and Nottinghamshire Electric Power Co. in 1919 and for about eight years before the nationalisation of electricity supply was general manager of that company, the Leicestershire & Warwickshire Electric Power Co., the Midland Electric Light & Power Co., and the Tamworth District Electric Supply Co. Upon nationalisation he became chairman of the East Midlands Electricity Board and since 1957 he has been deputy-chairman of the Central Electricity Generating Board. Mr. King has served as president of the Electrical Industries Benevolent Association and chairman of the Council of the British Electrical Development Association and of the National Inspection Council for Electrical Installation Contracting. He is also chairman of Derby County Football Club

Mr. C. R. KING, C.B.E., COMPANION I.E.E., M.Inst.F.

PRESIDENT OF THE BRITISH ELECTRICAL POWER CONVENTION

THE TORQUAY CONVENTION

ELECTRICITY AND THE STANDARD OF LIVING



A. *Exhibition* **B.** *Pavilion* **C.** *South Devon Technical College* **D.** *Callard's Café* **E.** *Town Hall* **F.** *Post Office* **G.** *Information Bureau*

Next week the eleventh British Electrical Power Convention is being held at Torquay under the presidency of Mr. C. R. King, deputy chairman of the Central Electricity Generating Board. The theme this year is "Electricity—Its Contribution to the Standard of Living." As will be seen from the programme outline given below, the papers will cover nuclear power, "Priority No. 1" (a comprehensive survey of electricity's part in modern life), and electrical installation work and inspection. The popular "Electrical Forum" is to be held once again and there will be the usual exhibition, open to both Convention delegates and members of the public. Illustrated particulars of the equipment to be shown appear on subsequent pages

Convention Programme

MONDAY, 1st JUNE

10 a.m. to 9 p.m. North Quay, adjoining the Pavilion. Preview of Electrical Exhibition for delegates and ticket holders.

1 p.m. Callard's Café, Fleet Street. Rotary Club Luncheon.

3 p.m. Official Opening of Electrical Exhibition by the President, Mr. C. R. King, C.B.E., Companion I.E.E., M.Inst.F.

Churston Golf Course. Men's Golf Competition.

Torquay Golf Course. Ladies' Golf Competition.

(Both in aid of the Electrical Industries Benevolent Association.)

TUESDAY, 2nd JUNE

10 a.m. The Pavilion. Opening of the Convention and Civic Welcome by the Mayor of Torquay. Presidential address by Mr. C. R. King.

12.15 for 12.45 p.m. South Devon Technical College. Electrical Association for Women's Luncheon.

2.45 p.m. The Pavilion. Paper on "Progress on the first Nuclear Power Stations—Bradwell, Berkeley, Hinkley Point and Hunterston" by F. H. S. Brown, B.Sc., M.I.Mech.E., M.I.E.E. (Central Electricity Generating Board), and J. Henderson, M.C., B.Sc., A.R.T.C., M.I.E.E. (Chief Engineer, South of Scotland Electricity Board). Discussion.

8 p.m. Town Hall. Reception by the Mayor and Mayoress of Torquay, followed by dancing.

WEDNESDAY, 3rd JUNE

9.30 a.m. The Pavilion. Paper "Priority No. 1," by A. N. Irens, M.Sc., D.F.H., M.I.E.E., M.Amer.I.E.E. (Chairman, South Western Electricity Board). Discussion.

10.30 a.m. Imperial Hotel. Ladies are invited to take coffee with Mrs. King.

2.45 p.m. The Pavilion. Paper on "The Scope of Installation Engineering" by C. C. Hyams, M.M. (President, Electrical Contractors' and Allied Associations). Paper on "The National Inspection Council for Electrical Installation Contracting—Its Objects and Organisation" by E. J. Sutton, M.I.E.E. (Chief Technical Officer, National Inspection Council). Discussion.

THURSDAY, 4th JUNE

9.30 a.m. The Pavilion. Lecture demonstration on "Lighting and the Common Weal" by O. W. Humphreys, C.B.E., B.Sc., M.I.E.E., F.Inst.P. (Director, Research Laboratories, General Electric Co., Ltd.). Discussion.

7 for 7.30 p.m. Palace Hotel. Annual Dinner.

9 p.m. Town Hall. Cabaret and Dance.

FRIDAY, 5th JUNE

10 a.m. The Pavilion. Electrical Forum. The Panel will consist of Sir Christopher Hinton (chairman, Central Electricity Generating Board), Mr. W. S. Lewis (chairman, Midlands Electricity Board), Mr. H. G. Nelson (managing director, English Electric Co., Ltd.) and Sir Henry Self (chairman, Electricity Council).

12 noon. The Pavilion. Annual General Meeting.

Convention Exhibition

PREVIEW OF EQUIPMENT ON SHOW AT TORQUAY

THE Electrical Exhibition at the 11th British Electrical Power Convention at Torquay, although not quite as large this year as it has been on previous occasions, will, nevertheless, provide once again an interesting accompaniment to the Convention.

Organised by the British Electrical Development Association, the exhibition will be conveniently situated on the North Quay, next door to the Pavilion where the Convention meetings will be taking place. A large tented building, covering an overall area of 11,600 sq ft, will house the 40 or so firms and associations that are participating. For the convenience of visitors, an illuminated indicator board, providing a quick and easy guide to the various stands, will again be provided by the *Electrical Review* at the entrance.

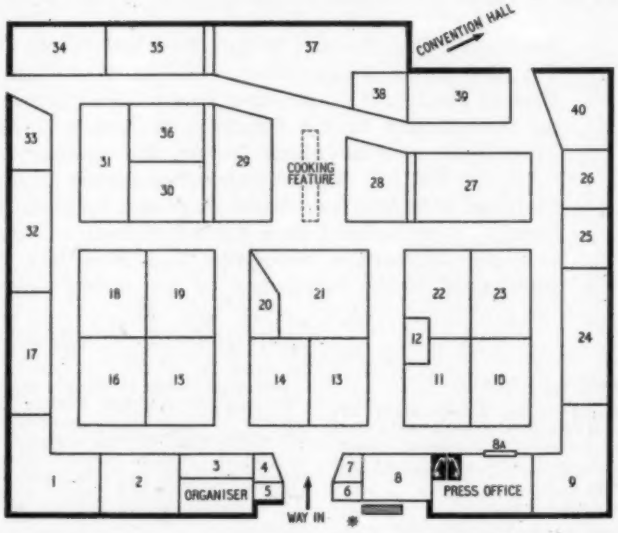
The official opening will be by the president, Mr. C. R. King, at 3 p.m. on Monday, 1st June. The exhibition will, however, be open to delegates from 10 a.m. to 9 p.m. on that day and each day until Friday, 5th June, when it will be open from 10 a.m. until 1 p.m. The public will be admitted free on the Tuesday and Wednesday afternoons and on Thursday and Friday. It will be closed daily from 1 p.m. to 2.30 p.m.

A special feature of this year's exhibition will be a display of electric cookers provided by the newly-formed Modern Cooking Promotional Committee. Each of the nine firms composing the Committee will be exhibiting one of its newest models in a display designed to show the advantages of modern electric cookers. The cookers to be exhibited are the Belling No. 59 "Classic"; Carron L.75; Creda "Mercury de-Luxe"; English Electric model 2031; Falco Mk. IV; G.E.C. "Supreme"; Jackson model 394.JHD; "Revo-Luxe"; and the Tricity "Marquis." The stand will be staffed by members of the South Western Electricity Board.

The latest types of lighting equipment, lamps and

LIST OF EXHIBITORS AND PLAN OF EXHIBITION

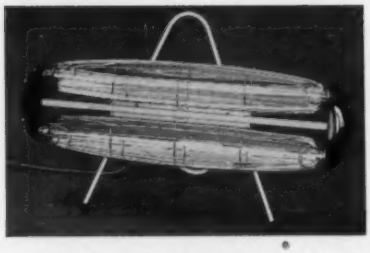
AIDAS ELECTRIC, LTD., Sadia Works, Rowdell Road, Northolt, Middlesex 16
ASHLEY ACCESSORIES, LTD., Ulverston, Lancs... ... ... 8A
H. J. BALDWIN & CO., LTD., Baldwin House, Nottingham... 40
BELLING & CO., LTD., Bridge Works, Southbury Road, Enfield, Middlesex 21
BRISTOL SIDDELEY ENGINES, LTD., Filton House, Bristol 8
BRITISH INSULATED CALLENDER'S CABLES, LTD., Prescot, Lancs ... 18
BULPITT & SONS, LTD., St. George's Works, 132, Icknield Street, Birmingham, 18 1
BURCO, LTD., Waterside Mill, Burnley, Lancs... 31
CENTRAL ELECTRICITY GENERATING BOARD, Winsley Street, London, W.1 37
E. K. COLE, LTD., Ekco Works, Southend-on-Sea, Essex 15
DARRAGH, SMAIL & CO., LTD., 41, Queen Street, London, E.C.4. ... 2
DIMPLEX, LTD., Millbrook, Southampton 11
ELECTRICAL ASSOCIATION FOR WOMEN, 25, Foubert's Place, London, W.1 4
ELECTRICAL INDUSTRIES BENEVOLENT ASSOCIATION, 10, Buckingham Palace Gardens, London, S.W.1 6
"ELECTRICAL JOURNAL," Bouverie House, Fleet Street, London, E.C.4 33
ELECTROLUX, LTD., 153-155, Regent Street, London, W.1 19
E.M.I. SALES & SERVICE, LTD., Hayes, Middlesex 30
ENGLISH ELECTRIC CO., LTD., Queen's House, Kingsway, London, W.C.2 28
GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2 14
HEATRAE, LTD., Heatrae Works, Norwick, Norfolk 32
W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., 51-53, Hatton Garden, London, E.C.1 36
HOOVER, LTD., Perivale, Greenford, Middlesex 29
MACLAREN, ROBERT, & CO., LTD., Eglinton Works, Kilbirnie Street, Glasgow, C.5 35
R. & A. MAIN, LTD., Electrical Division, 48, Grosvenor Gardens, London, S.W.1 10
M.K. ELECTRIC, LTD., Wakefield Street, Edmonton, London, N.18... 22



* "Electrical Review" guide to the stands

NATIONAL INSPECTION COUNCIL FOR ELECTRICAL INSTALLATION CONTRACTING, Aldine House, 10-13, Bedford Street, London, W.C.2 ... 7
PARKINSON COWAN APPLIANCES, LTD., Stechford, Birmingham, 33 ... 26
A. REYROLLE & CO., LTD., Hebburn, Co. Durham 24
SANGAMO WESTON, LTD., St. George's Court, 22-26, New Oxford Street, London, W.C.1 23
SANTON, LTD., Somerton Works, Newport, Mon. 9
SIEMENS EDISON SWAN, LTD., 155, Charing Cross Road, London, W.C.2 13
SOUND DIFFUSION (AUTO-THERMATIC), LTD., Duracraft Works, Portslade, Sussex 3
SOUTH WALES SWITCHGEAR, LTD., Blackwood, Mon. 27
SOUTH WESTERN ELECTRICITY BOARD, Electricity House, Colston Avenue, Bristol, 1 38
STERLING CABLE CO., LTD., Aldermaston, Berks 39
TACK ORGANISATION, Longmoore Street, London, S.W.1 20
TATE ENGINEERS, LTD., 100-106, Old Shoreham Road, Portslade, Sussex 12
TETRA ENGINEERING CO., LTD., 1-3, Redhill Street, London, N.W.1 25
WANDLESIDE CABLE WORKS, LTD., 106, Garratt Lane, London, S.W.18 34
WILKINS & MITCHELL, LTD., "The Hollies," Hollies Drive, Wednesbury, Staffs 17

Ekco type FRC2 "Thermovent" plastic-fronted heater



Dimplex 1,500 W portable infra-red fire

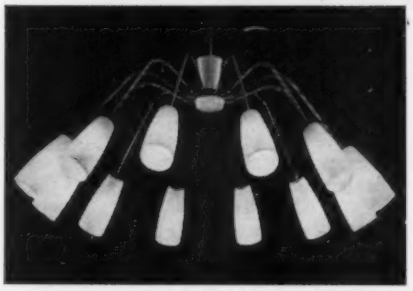
Right: English Electric 5 kVA rural distribution transformer

industrial heating equipment will be shown on the General Electric Co.'s stand. Prominent among the exhibits will be an example of the "Comfort in Lighting" range of fittings employing a new G.E.C. technique for producing high levels of illumination without glare. Visitors will also be able to see the company's new "Variform" range of contemporary design fittings. By assembling a series of parts in different ways a variety of fittings can be built up in types ranging from three-light pendants for domestic use to 12-light units suitable for commercial use. Among new ranges of decorative fittings which will be on view are the "Leaf" range, which gives a choice of three, four or five-light pendants and two-light matching wall brackets, and the "Friendly" range (three-light pendant and one and two-light wall brackets). Both are attractively finished in satin brass; the "Leaf" with black relief and a green enamelled leaf as a central motif and the "Friendly" with a choice of eight shade patterns. The range of "Osram" lamps and tubes displayed will include a new 2 kW quartz tubular infra-red heater, and samples of new vertical operation heaters, suitable for the catering trade, will also be seen.

The display of street lighting lamps includes a new 280 W integral sodium lamp, while a new street lighting lantern for side road lighting will be shown for the first time. The G.E.C. "Nightstor" heaters are now available in four models, 1 kW, 1½ kW and two versions of a 2½ kW model, and an example of the range will be shown. Other industrial heating equipment will include a range of unit heaters and an overhead radiant heater. The latter is available in narrow- and broad-beam versions in 1½ and 3 kW sizes. Another section of the stand will show the "Sanfire" electric sanitary incinerator fitted with solid-rod elements similar to the type used in electric furnaces.

On the Siemens Edison Swan stand some of the latest trends in lighting equipment will be on view, with typical examples of new developments designed to meet the requirements of individual lighting planning authorities. Among the street lighting lanterns to be displayed will be one of the "Kuwait" range—the 3ft "Carpenter" lantern; two wall mounting lanterns—the "City of London" and the "Chester"; a post-top lantern; and one of the "Orson" group of sodium lanterns. In the electrical accessories section of the stand exhibits will include a cooker control unit; lampholders; switch socket outlets and 13 A accessories. Batteries and accumulators will also be displayed, while the Cables Division will be showing samples of dual-voltage cable as used on a.c./d.c. locomotives.

The theme of the Dimplex display will be forward-thinking heating appliances for the home, commerce and industry. On the domestic side the company will show



A 12-light pendant fitting from the G.E.C. "Variform" range

their recently introduced portable infra-red fires which gained a first award at this year's Electrical Engineers' Exhibition. Two models are available, with 750 and 1,500 W loadings, the larger model being fitted with a full/half-heat switch. One of the company's latest developments is a wall-mounted infra-red heater with its own built-in double-pole switch. This will be shown at Torquay for the first time. Other Dimplex domestic heaters include the "Major" and "Minor" oil-filled electric towel rails with loadings from 90 to 200 W, all of which have a choice of chromium or satin enamelled finish. Oil-filled electric radiators rated at from ½ to 3 kW and in a range of nine colours will also be displayed, together with skirting-board styled convectors. These last-named convectors can be built up in multiples as required and are available in 2ft (300 W) and 3ft (500 W) lengths. For commercial premises Dimplex will offer their range of ceiling-mounted infra-red heaters. The reflectors of these can be supplied in natural or copper coloured anodised aluminium. Industrial overhead radiant heaters in 2½ and 4 kW sizes will also be shown, together with flameproof oil-filled radiators for use in inflammable atmospheres.

Since last year's exhibition a new wall mounting convector, type WM, has replaced the previous MRL heater produced by E. K. Cole, Ltd. An example of this will be seen on the "Ekco" stand, where the company will also exhibit a comprehensive range of other space heating equipment. The recently introduced WM series are available in two sizes, 1¼ and 2½ kW, and both models have a projection from the wall of only 5½in. They are finished in attractive hammer-bronze enamel and a 40 W amber-sprayed lamp produces a warm luminous effect. The company's K series portable 2 kW convectors and the FR range, with moulded plastic front panels, will also be on show, as well as steel-cased portable models for

Hoover "De-Luxe" cleaner, model 652, with cleaning tools and double-stretch hose

Left: Servis "Rinspin" spin dryer (Wilkins & Mitchell, Ltd.)

Main No. 22 2·2 cu ft absorption type refrigerator

either commercial or domestic use. Portable reflector fires in the "Ekco" range will be represented by the "Victor" series (1 to 2½ kW). Other types on view will be the "Flamera" imitation coal effect fire; the "Minora" 2 kW low-level wall fire which requires no recess; and the "Firestreak" infra-red wall fire, suitable for almost any situation. The company will also show a representative range of their "Warm-Glow" electric blankets, including the "Vigilux" models with variable thermostatic bedside controls; radiant-glass heating panels; high-temperature panel heaters for commercial use; thermal storage heaters; and tubular heaters. Another section will include industrial unit heaters from 3 to 10 kW; soil heating cables; pipe defrosters; and other special-purpose heaters.

A representative display of electric fires and convectors in various coloured finishes will be seen on Belling & Co.'s stand. Electrically heated drying cabinets and towel airers will also be displayed and, of special interest to the hotel and catering industry, a plate and dish warming cabinet. The company have for many years specialised in "Baby" cookers, particularly suitable for use in very small kitchens, caravans, chalets, etc., and examples of these will be shown.

A new rural distribution transformer claimed to involve low capital expenditure and to require negligible attention is to be one of the exhibits in the English Electric Co.'s display. It consists of 5 kVA core and windings using the uncut wound core construction, contained in a mild steel tank. The two half-pressings are hermetically sealed against dust and moisture or, alternatively, a plain type breather can be fitted to allow free breathing in temperate conditions. Examples of both the light and heavy design of "Red Spot" distribution fuseboards, the primary consideration of which is the safety of operating personnel, will be shown, as well as a selection of "Red Spot" fuse bases and carriers. As examples of the company's extensive range of h.r.c. fuselinks there will be displayed a selection of the "T" type fuselinks. The company's industrial machines will be represented by Class "C" ventilated motors which are designed to B.S. 2960 and B.S. 2613. These are smaller, lighter and cheaper than previous motors of this type. Outputs are from ½ to 50 h.p. Among meters on display will be a number of integrating types for both single-phase and polyphase applications. An interesting feature of the standard type B31B single-phase house service meter is that it has numerals twice the normal size, thus making for easier reading. The polyphase meter range includes meters in flush draw-out cases so that the meter elements can be completely withdrawn for inspection and maintenance. They can be fitted with maximum demand indicators and, if required, with alarm contacts. From the company's range of protective and auxiliary relays, there will be a negative sequence relay, primarily designed for use on the St. Lawrence Seaway project and now available for 50 c/s applications. Electrical measuring instruments will include miniature panel types designed with a higher than normal torque/weight ratio.

South Wales Switchgear will be showing many designs of equipment from their current manufacturing range, including some new developments in both the transformer and switchgear fields. Of particular interest will be a 500 kVA, 11 kV/433 V transformer built to T.1 specification. This uses a newly-developed method of tube brazing which results in a transformer with accessibility to all cooling tubes. A three-panel control and relay board and an 11 kV, 400 A single busbar air insulated switch unit will also be shown. The latter unit is fitted with a new design of auto-reclose scheme for three reclose operations, with recommencement of sequence if the line attains its normal condition within the three-operation cycle. From the Domestic Appliance Division of the associated company (Treforest Electrical Services) a selection of wash boilers and clothes dryers will be demonstrated.

A newcomer to this exhibition is Sound Diffusion (Auto-Thermatic), Ltd., who will be showing their "Datafonic" Mk. I and Mk. II supervisory systems. The object of the systems is to provide a central control room with supervision of electrical circuit-breakers and other equipment, without incurring the high costs of privately rented Post Office lines. It is applicable to many branches of industry and public utility engineering and finds considerable application in the fields of electricity, gas, water, oil and automated control systems. It was designed initially to meet a requirement of the C.E.G.B. and the Post Office have granted approval to the line circuits of the system for substations operating at up to 132 kV.

On the Hoover stand a completely new "De-Luxe" cleaner will be exhibited for the first time. Coloured in pearl white and heather rose, it is lower in height, 1½ lb

less in weight and claimed to be 20 per cent more efficient than its predecessor. "Hooverflex" double-stretch hose is fitted and the cleaning tools are attached by a newly-designed convertor housing, which can be instantly fitted at the back of the cleaner below the dust bag. The agitator bars and brushes operate over a 17 per cent wider area, achieved by increasing the agitator length in proportion to the cleaner width, and a wide-angle "dirt-finder" light helps to find the dirt in dark corners. The handle, held by a foot-operated latch, is adjustable to three positions, while the use of another foot latch, coupled with a quick press down on the handle, gives an instantaneous adjustment of wheel height. The machine is double insulated and the power consumption is 385 W.

Prominent among other Hoover exhibits will be the recently introduced model 1334 "Junior" cleaner and the "Spinarinse" spin dryer. The cleaner, which will be shown with its cleaning tools and double-stretch hose, is fitted with a special device for the instant attachment of the cleaning tools. With it the agitator driving belt is automatically uncoupled from the motor pulley when the tools are to be used. With the "Spinarinse" spin dryer, up to 6 lb of clothes (dry weight) can be rinsed as well as spun without removing the clothes from the machine. It has been introduced following the success of the company's "Hoovermatic" combined washing machine and spin dryer. It is pump emptied through a rigid plastic water outlet pipe which can be instantly swivelled to retain the hot suds for further use, or adjusted to sink height to run off the rinse water. The machine is rectangular in shape and is styled in white, blue and grey.

Apart from these latest additions to the company's ranges of cleaning and home laundry equipment, there will also be shown examples of the Hoover range of f.h.p. motors. These include the latest Mk. IV motor, the range of which has been extended to include three-phase motors from one-sixth to ½ h.p. These add considerably to the number of types available but do not supersede the "square" Mk. II motor which continues to be made in large quantities.

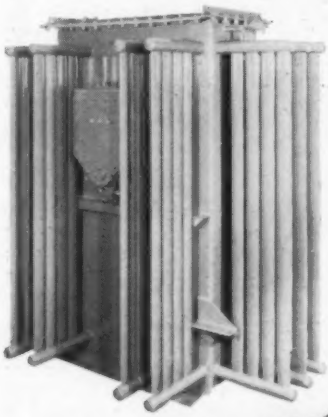
Refrigerators and vacuum cleaners will form the main display of Electrolux, Ltd. One of the latest additions to their range of absorption type refrigerators is the L.26, designed for the lower price market. Although it occupies surprisingly little kitchen space, the capacity is 2½ cu ft and up to nine pint bottles of milk can be stored on its upper shelf. Other models in the Electrolux range include the L.37, the L.500 and the largest model in the range, the L.76. With 14¼ sq ft of shelf area, this last-mentioned refrigerator has an interior light, a full-width frozen food compartment and a draw-out shelf which enables food to be removed easily. Built-in models, as supplied to local authorities and builders for installation in kitchen units, etc., will also be on view. The company's model 62 vacuum cleaner fitted with new type runners, plus nylon rollers, will be shown in the cleaner section of this stand. For this model a turbo-polisher attachment is available as an optional extra. The company's smaller, model 60, vacuum cleaner will also be on view, as well as the model B.9 floor polisher. For industrial use, there is the Electrolux model 33, a heavy duty suction cleaner suitable for use in hotels, cinemas, hospitals, etc. The body is supported on three wheels, one of which acts as a steering wheel.

Early this year R. & A. Main, Ltd., extended their range of domestic refrigerators by the introduction of an inexpensive 2·2 cu ft absorption model. Known as the Main No. 22, it is of the same height as the standard kitchen unit (36in) and its compactness makes it ideal where space is a vital consideration. This model will be on show on the company's stand, as well as a 3·6 cu ft model which is claimed to be the only refrigerator with a ten-year guarantee on its sealed cooling unit. Laundry appliances are also produced by this company and among their exhibits will be shown the Main No. 55 electric 10-gal wash boiler and the "Mainspin" spin dryer.

A spin dryer may also be seen on the stand of Wilkins & Mitchell, Ltd., where the company will exhibit their new "Rinspin" model. This spinner has a special "deep-rinse" action whereby the clothes, after washing, are totally immersed in clean rinsing water. This is achieved by means of a spinner cylinder incorporating a series of slots in the top casting instead of the usual perforations in the side of the drum. The company's full range of "Servis" washing machines, which include the "Superheat," "De Luxe," "Powerglide" and model S, will also be on view.

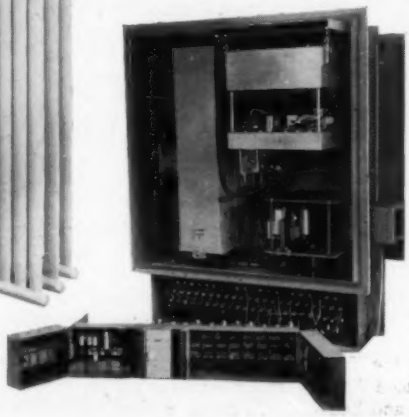
A preview of an entirely new spin dryer, the "Pirouette," will be a feature of the stand of Parkinson Cowan Appliances, Ltd. It is understood that this new dryer will be generally available later in the year.

On the Burco stand exhibits will include wash boilers,



South Wales Switchgear 500 kVA "new look" transformer

"Datafonic" Mk. I supervisory system (Sound Diffusion)



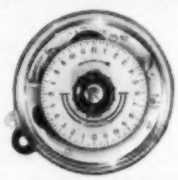
Electrolux model M.27 built-in refrigerator

washing machines, and the "Tumblair" clothes drying machine. Among these will be an improved version of the company's well-known "Baby Burco" wash boiler. It is easy to lift, weighing only 10¼ lb, and has a capacity of 5½ gal. The loading is 2½ kW and approximately 4 lb (dry weight) of clothes can be dealt with at one time. A special feature of the model 305 wash boiler and the "Three-Ten" boiler-wringer is an electrically operated emptying pump. The "Three-Ten" can be fitted with a hand agitator unit to convert it into a complete washing machine.

The "Swan Brand" range of electric kettles is claimed to be one of the most comprehensive to be offered by any manufacturer and on Bulpitt & Sons' stand a wide choice of models will be displayed. They will include the fast boiling kettles, the "Swift" and "Siren," and a third model which has been added just recently. This is a three-pint, 2 kW "Royal" kettle (Cat. No. CH.103B). A fully automatic coffee percolator, the "Winchester," will be shown for the first time. It is a chromium-plated aluminium model of the "Dorchester" polished aluminium percolator and it is capable of producing two pints of coffee at a time. Other appliances to be seen on this stand will include toasters, urns, blankets, immersion heaters and a range of ground-base aluminium holloware.

H.M.V. household appliances to be seen on the stand of E.M.I. Sales & Service, Ltd., will include electric irons in four colours; portable fan heaters; and electric blankets. The blankets are available in single- and double-bed sizes and are manufactured to conform to the requirements of B.S. 2612.

"Baby Burco" 5½ gal electric wash boiler



Sangamo Weston spring reserve time switch (24 hour dial type)

Above: Bulpitt "Winchester" coffee percolator

Left: H.M.V. "Salisbury" fan heater (E.M.I. Sales & Service, Ltd.)

In addition to the "Thermat" and "Lylux" electric blankets, H. J. Baldwin & Co., Ltd., will also be showing a representative selection of the "Wireohms" range of heating elements.

A range of extractor fans to be shown by the Tack Organisation will include their recently introduced "Nu-Aire Junior" designed for the smaller kitchen and bathroom. The display will also include the company's "Saxane Junior," an electrical appliance claimed to rid the home of flies, moths, etc.

Pride of place on the stand of Aidas Electric, Ltd., will be taken by the "Sadia Two-Plus." It has a storage capacity of 2·2 gal and the loading is 1 kW, thermostatically controlled. The finish is in four colours—light blue, light green, parchment and white—with chromium fittings. The company will also be showing their 20 gal UDB pressure type water heater. Two heating elements are incorporated in this model, the upper 1 kW element, thermostatically controlled, keeping 6 to 7 gal of hot water ready for immediate use. For larger quantities of hot water the lower 2 kW element may be switched on. Several other "Sadia" water heaters will also be displayed.

Heatrae, Ltd., will be showing a comprehensive range of their domestic equipment, particular emphasis being placed on their water heaters. These will be basically the standard "Lido" range, including the latest "Lido Express" water heater. It has a loading of 3 kW and is claimed to be capable of providing 9 gal of hot water every hour. Two features are of special interest on this heater. One is the "economy eye," which operates when the element is in circuit under the control of the thermostat and it has a two-fold purpose—one to indicate the short time during which current is being taken to provide hot water and, two, to show when the full contents of the water heater are available. The other item of interest is the disposal end at the outlet spout of the heater which, in conjunction with a control valve, provides automatically a fully controlled flow of water with any degree of incoming water pressure. Also to be seen on the Heatrae stand will be the company's "Pluto" water heater for installation under a wash basin or sink. This will be shown installed and working with a patented "Pluto-Matic" system, claimed to be an entirely new idea. Details of this will be available at the exhibition, when the system will be shown for the first time.

A selection of thermal-storage water heaters, of various capacities and including examples of the new "Lincoln" heater with its plastic-coated steel finish, will be shown by Santon, Ltd. This finish is also used for the company's 2½ gal "Conway" heater specially designed for installation beneath a sink, basin, or bar counter. It can be used as a pressure type heater when connected to the usual ball-valve tank and fitted with a vent pipe in the conventional manner. The standard loading is 1½ kW. Domestic immersion heaters in a variety of lengths and loadings will also be displayed by Santon, in addition to industrial immersion heaters selected from a large range designed for the heating of bulk hot water, oils, acids, etc. There will also be a representative selection of rotary switches, from 10 to 500 A, and examples of a new lockable handle switch.

Switches and a wide range of electrical accessories for both domestic and industrial installations will be displayed by M.K. Electric, Ltd. These will include plugs of all sizes, socket and switch socket outlets, cooker control units, etc.

On the stand of Ashley Accessories, where a wide range of moulded wiring accessories may be seen, items of special interest will include 13 A heavy duty surface switch socket outlets. These new accessories have been specially designed to withstand rough handling in industrial premises, being substantially moulded in a special material. They are available in black only and the type number is SS.41.

Mineral embedded tubular sheathed elements for

domestic, industrial and commercial applications are to be shown by the Tetra Engineering Co., Ltd. A full range will be on view, including elements for the heating of water, chemicals, oils, etc., with sheath temperatures of up to 1,000 deg C. Finned elements for use in convection heating, infra-red drying, grain and crop drying, heat exchangers and oil heating, will also be on view. These can be supplied in lengths up to 14ft in copper, mild or stainless steel, or aluminium, straight or bent, as required.

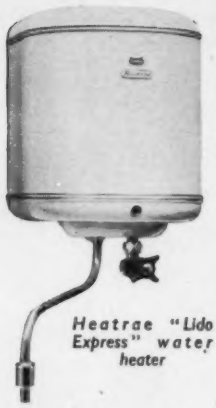
From the Sangamo range of time switches, including 24-hour dial types, solar dial types, change-over models, short interval switches, process timers and hour meters, some sixteen models will be on view on the Sangamo Weston stand. Two versions of the newly-introduced spring reserve time switch will be shown—24-hour and solar dial models. A feature of this switch is that the escapement is normally synchronised to the required frequency thus assuring the desired accuracy of time keeping. A representative selection of Weston electrical measuring instruments, including panel and switchboard types, portable instruments and laboratory standards, will be on show, together with examples of Weston aircraft instruments.

Wandleside Cable Works, Ltd., will be joining with its associated companies, Irish Cables, Ltd., and Wandleside Warren Wire Co., Ltd., in exhibiting a complete range of wires, flexibles and cables. Special attention is being paid to "Teflon" insulation, both as a dielectric for special types of high-temperature operating cables and as an insulant in the form of "Teflon"/glass impregnated tapes and yarns. They are claimed to be capable of operation from −60 deg C to +250 deg C and to have electrical characteristics and physical and chemical properties unsurpassed by other commercial types of cable. Among other recent developments in the Wandleside range of cables to be displayed will be the "Florawarm" floor embedded heating cables; "Hortiwarm" glasshouse and soil warming cables; "Hitem" heat-resistant thermo-plastic insulation; and "Corrutrack" armoured cable for railway signalling and track feed uses.

Samples of mains cables, including plastic insulated types; metallic flexible armoured cables and cords; cables for railways, ships and aircraft; colliery cables; telephone cables; and winding wires, will be shown by W. T. Henley's Telegraph Works Co., Ltd. There will also be a selection of bare and p.v.c. insulated overhead line conductors on this stand. Distribution equipment will include a typical distribution pillar, ironclad and insulated service fuses, outdoor service fuses, circuit-breakers, consumers' control units and terminal glands for p.v.c. insulated wire armoured cables. The recently introduced range of Henley plastic joint boxes for p.v.c. insulated mains cables will also be displayed.

Among the products to be shown by British Insulated Callender's Cables, Ltd., will be a selection of power cables and accessories. This exhibit will include a demonstration of compression jointing on copper conductor plastic power cables utilising the B.I.C.C. compression tool. The tool has a six ton capacity but weighs only 6 lb. Additional items include a selection of low-, medium- and high-voltage cables with emphasis on oil-filled and 33 kV mass impregnated non-draining types. Mineral insulated cables and a complete range of cables for domestic and industrial application will also be displayed. The "Panelec" rewirable floor warming system has been completely redesigned and now includes the provision of fully cladded access troughs, preformed return bends, and composition intermediate and end sleeves. The introduction of these components facilitates assembly and is claimed to reduce installation costs by 20 per cent, and examples of the cables will be displayed.

Santon "Conway" 2¼ gallon water heater



Heatrae "Lido Express" water heater

"Teaboy" electric tea maker (Darragh, Smail & Co., Ltd.)

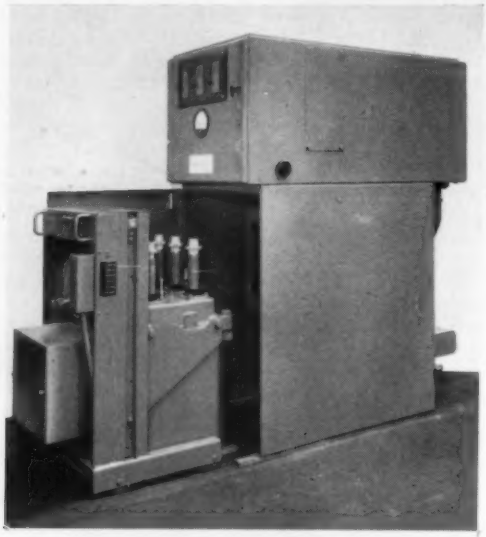
Tate Engineers, Ltd., will be showing their compression jointing equipment for use in conjunction with steel-cored aluminium conductors on high-voltage overhead power lines. This will include lightweight hydraulic compressors, dies, dead-end assemblies, mid-span joints, bi-metal connectors, etc.

An entirely new series of "Convectorstats," designed particularly for electric space heating equipment, will be shown by Robert MacLaren & Co., Ltd. Two patterns are available with ranges of 65 and 100 deg F respectively. Both are for single-hole fixing with an earthed bi-metal operating positive-acting snap switch. Other exhibits will include the company's type MO oven thermostat, a rod pattern instrument for domestic electric cookers, and a dual-purpose thermostat for greenhouse use. The type MB thermostat will also be on view; this is available in standard stem lengths of 7, 11 and 18in and can be supplied either with a fixed temperature setting or with an adjusting knob covering standard temperature ranges. The "Thermo-Time" regulator, an instrument that provides a temperature-time programme for domestic heating installations, will also be exhibited on this stand.

A revolutionary way of making tea will be demonstrated by Darragh, Smail & Co., Ltd., with the use of their "Teaboy" combined kettle/teapot/hot-water jug. The

action is similar to that of a coffee percolator and as the water and tea leaves are kept apart it is claimed that tea made in this appliance can never be " stewed."

Heavy switchgear will be represented on the Reyrolle stand where the company's new 6·6/11 kV oil break



Reyrolle 11 kV oil-break circuit-breaker

circuit-breaker will be on view. This vertically isolated 400 A circuit-breaker has a making and breaking capacity rating of 150 MVA at 6·6 kV and 250 MVA at 11 kV. The voltage transformer when fitted is mounted in another compartment above the cubicle. Either an independent manually operated or a spring closing mechanism can be provided. The company are also showing their recently introduced high-speed auto-reclosing outdoor pole-mounting circuit-breaker, with a current rating of 200 A and a breaking capacity of 75 MVA at 11 kV. To complete the display, a range of pull-cap cartridge fuses and industrial plugs and sockets will be shown.

The Central Electricity Generating Board will have as their principal exhibit an animated map using coloured lighting to illustrate the positions and operation of the Board's power stations and the main transmission system. The power stations will be shown as nuclear, coal and oil fired, and hydro-electric; and both the 132 kV grid and 275 kV supergrid systems will be outlined. Publications and general information on the functions of the Board will be available from an inquiry desk.

Two stands will be occupied by the South Western Electricity Board, one of which will present a documentary history of the Board's activities and achievements since its inception in 1948. On the other stand will be a large model of a recently developed turbo-generator, designed to relieve the power load at peak periods and described in the *Electrical Review* of 1st May. The Bristol Aircraft Co. are the manufacturers of this exhibit and they will be responsible for the staffing of the stand.

As in previous years, the Electrical Association for Women will be represented at the exhibition and their stand will feature the ring circuit system of wiring and the convenience of the standard 13 A fused plug. Four special panels will illustrate the five circuits in the modern home for cooking, water heating, fixed lighting, floor warming, and movable equipment. The safety aspect of the well-wired home will be stressed.

The theme of adequate wiring will also be stressed on the stand of the National Inspection Council for Electrical Installation Contracting, where, by means of photographs and other material, the importance of correct wiring of adequate capacity in the electrical installation itself, will be emphasised. Copies of the Council's literature and Roll of Approved Electrical Installation Contractors will be available on this stand.

Commonwealth Telephone Cable

LAST week Cable & Wireless, Ltd., announced that it had placed an order with Standard Telephones & Cables, Ltd., for ninety-two submerged two-way repeaters and eleven submerged equalisers of British design for the transatlantic section of the Commonwealth round-the-world telephone cable, at a cost of about £1,800,000. They will be made at Standard Telephones' North Woolwich factory and will be jointed into the cable, which is to be laid between Scotland and Newfoundland in the summer of 1961.

The repeaters consist of rigid watertight casings containing duplicate three-valve amplifiers arranged so that, in the event of a failure of one amplifier, the repeater will continue to work. The life of the valves is estimated to be not less than twenty years. They will lie on the ocean bed at average intervals of about 23 nautical miles, in depths varying from a few fathoms to approximately 2¼ miles, where the water pressure is over 2½ tons to the square inch. The equalisers, which will have similar watertight casings, will be inserted in the cable at intervals of some 200 miles. They will contain equipment for correcting inequalities of signal strength at different frequencies.

The transatlantic section will consist of a single coaxial cable specially developed in Britain by the Post Office for use with two-way rigid repeaters. The deep-water portion will consist of a new type of lightweight cable in which there is no armouring, a steel core providing the tensile strength. It will provide, at any time, for sixty simultaneous telephone conversations. The estimated total cost of the section is £6,000,000. It is being jointly financed by Cable & Wireless, Ltd., and the Canadian Overseas Telecommunication Corporation.

An order for 552 miles of armoured cable for the shallow water stretches and shore-ends at a cost of £750,000, was placed by the company on 10th March, with Submarine Cables, Ltd., which will make the cable at Greenwich. It is expected to be followed shortly by an order for 1,600 miles of lightweight cable for the deep-sea stretches at a cost of £2,250,000.

Instrument Technology

THE annual general meeting of the Society of Instrument Technology was held recently and was followed by the presentation of the Bowen Prize by Mr. R. Barrington Brock, president of the Scientific Instrument Manufacturers' Association, to Mr. J. E. Samson.

Mr. J. F. Coales then delivered his presidential address on "The Education of Instrument Technologists and Control Engineers." He advocated the introduction of control engineering as a primary technology taught at undergraduate level and gave syllabuses of proposed courses.

ELECTRICITY IN INDUSTRY

By P. W. R. GATLIFF, B.Sc. A.M.I.E.E.*

The application of electricity in industry is so widespread that it is now taken very much for granted. The central generation of power, its transmission over long distances and its utilisation have become such efficient processes that as a source of power for industry it has surpassed all others. The author surveys the various factors which have led to this state of affairs†

THE cost of electricity is often unduly exaggerated by works managements, possibly because they receive their electricity bills in widely-spaced regular doses. In fact, the cost of electricity is a very small proportion of the total production cost for most manufacturers, as the following table shows:—

Industry	Percentage of Total Production Cost
Textile	1·44
Cast Iron Foundry	1·00
Motor Cars	0·69
Shipbuilding	0·67
Bread and Flour	0·39
Hosiery	0·28

Obviously, every possible step must be taken to minimise the cost of electricity, but there is no doubt that in a factory there are many wastages that occur which, if properly supervised and corrected, could result in a considerable reduction in the total cost of production. The cost of labour is usually about 30 per cent of the total works costs, and recent recording-ammeter charts obtained at a number of factories showed that, judging by the use of machines, there is generally a considerable wastage of time at starting and stopping (both morning and afternoon) and a general falling off of effort after lunch. If this were corrected the saving in cost would exceed the total electricity charge.

A number of factors influence the cost of generating electricity. First, there is fuel. This is a large item, and although fuel prices seem to be continuously rising, there are other factors which contribute to cost reduction. One of these is the increasing efficiency of the modern power station.

The best station during the year ending December, 1958, was Castle Donington, with an average annual efficiency of 32·91 per cent. Within the next year or so, 34 per cent will be reached in the newest stations. However, the average efficiency throughout the country for the year 1957-58 was only 25·51 per cent due to the large number of comparatively inefficient turbines still at work, as shown in the following table:—

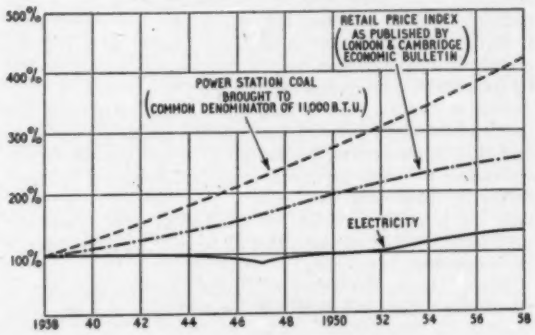
Station Efficiency	% of Total Capacity	% Units Generated
30% and over	7·8	10·5
26%–30%	35·3	49·8
20%–26%	33·5	31·4
10%–20%	20·0	7·2
Under 10%	3·4	0·1

This table also illustrates the endeavour of the Central Electricity Generating Board to generate as much energy as possible with the most efficient stations. It is interesting to note that the average efficiency throughout the country improved by 0·58 per cent during the year and that this represents an annual saving of 980,000 tons of coal.

By means of increased efficiency of power stations, and load factor improvements, the generating costs have risen very much less than other costs. This is strikingly illustrated in Fig. 1, which compares electricity costs with coal and the retail price index from 1938 to 1958.

The average annual load factor for 1957-58 was 48 per cent. Fig. 2 shows a typical British winter load curve.

Fig. 1.—Relative costs of commodities



* Chief Machine Control Engineer, English Electric Co., Ltd.

† This article is based on a lecture given by the author to the National Industrial Fuel Efficiency Service in September, 1958.

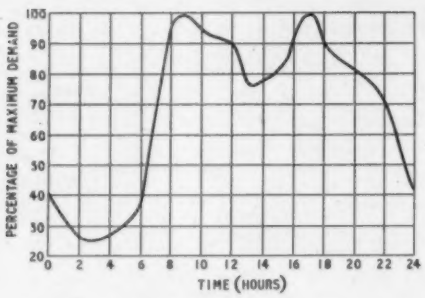


Fig. 2.—Typical British winter load curve

Obviously, great economies will result the nearer this is brought to a straight line, i.e. by eliminating the peaks and increasing off-peak loads, and so allowing the less efficient stations to be abandoned. With the coming of nuclear power this consideration has greater importance, because it will be necessary to run those stations continuously in order to recover their greater capital cost.

The national load factor is being improved in three ways:—

(1) Installation of water power which is as far as possible applied during periods of peak demand to reduce the maximum load on the steam stations.

(2) Pumped storage. Water is pumped up to a storage lake during off-peak periods and then used for generating at times of peak. The overall efficiency of the cycle is only 65 per cent but the 35 per cent loss is amply justified by other considerations.

(3) Off-peak tariff. A large number of Area Boards now encourage industrial, commercial and domestic users to take as much load as possible during off-peak periods by providing a special rate of about 0·75d per kWh. The load must be controlled by a time switch to ensure that it is generally used between 7 a.m. and 7 p.m., possibly with a boost of two hours at mid-day. This does, of course, apply largely to space heating.

There is also the projected Channel link. The advantage of this high-voltage d.c. cable link lies in the sharing of the peak demands between France and Britain. The shape of the French and British load curves differ quite considerably, so that the peak demands do not occur at the same time. The load factor in France is generally better than in this country.

Works Load Factor

This subject is just as important to the industrial user as to the C.E.G.B., particularly as the majority of tariffs now offered are on a maximum demand basis. There has for some time been some criticism of this form of metering, but it must be appreciated that the generating authority and Area Boards necessarily have plant and cables available to meet the worst possible conditions. It is fair and right that advantages should be given for improved load factor which is, of course, accomplished by the maximum demand tariff.

Due to the diversity of load in an Area Board network, the load factor at present has reached about 48 per cent and this is, of course, all to the ultimate benefit of the consumer. In any particular industry, however, the load factor is often very much less. If a factory is working only 44 hours per week, 50 weeks per year, then the load factor will be of the order of 20 per cent, and cannot be better than 25 per cent.

Fig. 3 shows the effect of load factor on the cost of electricity where a maximum demand tariff applies, and illustrates the great advantage of improving the load factor. Often the factory management can rearrange their power load without undue inconvenience to avoid rare maximum peaks that may adversely affect the electricity bill. It is quite common for a maximum demand alarm to be installed so that, on receiving audible warning that the normal demand will be exceeded at the current rate, some predetermined load can be temporarily eliminated. Alternatively, a diesel alternator set may be run for a short period to relieve the supply of heavy peak loads.

Power Factor

The capacity of generators, transformers, switchgear, cables, etc., is more or less proportional to the kVA load, and it is therefore rational for the electricity charges to be dependent upon power factor as well as kWh.

Generally, this is accomplished in one of two ways:—(a) Metering the maximum demand in kVA, which immediately takes account of power factors; (b) metering maximum demand in kilowatts and enforcing a penalty for power factor less than unity. Oddly enough, experience shows that consumers are more ready to correct their power factor if they see a definite monetary penalty, whereas they do not take the same notice of an equivalent charge when it is on a maximum demand kVA basis, as it does not become so obvious in the electricity bill.

Methods of arriving at power factor with a kilowatt charge vary, but the most usual is to install a kVAr integrating meter, which is then related to the integrated kilowatt meter and thus gives an average power factor over the whole period between metering.

Motors running on light load are, in the main, the cause of bad power factor. It can be corrected by the application of separate capacitors connected directly to the motor terminals of the larger machines, and this has the advantage also of improving the power factor over the feeder cables and distribution gear.

The size of the capacitor on the individual motor terminals should not at any time be greater than the no-load kVA of the motor, otherwise there is a possibility of self-excitation of the motor. If the capacitor size corresponds to the no-load kVA of the motor then, irrespective of load, the power factor is maintained at a high figure, and not less than 0·98 lagging on full load.

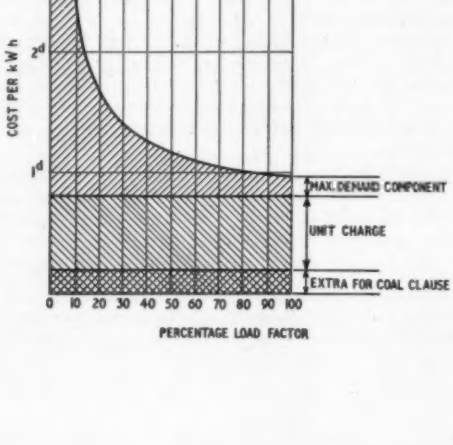


Fig. 3.—Analysis of typical maximum demand tariff (assuming unity power factor)

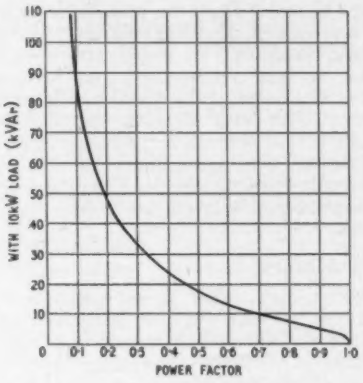


Fig. 4.—Power factor correction. Relationship between power factor and kVAr

Usually, it will be advantageous to top up the power factor by one or more capacitors in the substation, controlled either manually or automatically. The latter method will often be desirable in the event of a maximum demand kVA tariff.

Before nationalisation of the supply industry at least one authority allowed the MVAr meter to run backwards for leading power factor. The consumer was then able to run at a considerably lagging power factor during the day but, by leaving his capacitors connected through the night and during periods of no load, the kVAr meter would run back to about zero. Nowadays, however, all authorities fit ratchets to prevent this. Where new equipment is being installed, the larger motors can be of the synchronous type, to assist power factor improvement throughout the factory.

The capacitor size needed to improve any power factor can be reached from the curve shown in Fig. 4. For instance, assuming a 10 kW load, then at 0·7 power factor, the kVAr is 10 and at 0·9 power factor it is 5. Therefore, a 5 kVA capacitor would be required to improve 10 kW from approximately 0·7 to 0·9 lagging, and so on. It will be noted that the effort required to improve from about 0·95 to unity is comparatively great, due to the steepness of the curve at that point and it is not usually economic to improve the overall p.f. beyond 0·98 lagging.

Power factor correction becomes more complicated if there is a preponderance of a.c. welding or other load where the power factor is very bad, say about 0·3 lagging. Under these conditions it is not possible, without the introduction of some automatic device, to improve above about 0·6 lagging if metering is by maximum demand kVA. This is again illustrated by Fig. 4, for taking a 10 kW load at 0·3 lagging power factor, the kVAr is 30, and if it is corrected at 0·9 the kVAr is 5, then a 25 kVA capacitor is required. However, during periods of rest, i.e. lunch hour, etc., the capacitors may remain in service, and can form a maximum demand on the authority's meters. In the case described, the maximum demand would be 25 kVA at no load, and 11 kVA at full load.

One effect of power factor is not generally appreciated, and that is how it affects voltage over a run of cable. Generally, data provided to factory engineers give an unqualified voltage drop in a length of cable carrying a specified current. This is not in fact completely accurate (as shown in Fig. 5) because the voltage drop is dependent upon power factor and spacing of conductors. Although this is not likely to disturb the factory engineer unduly, on some occasions it must be taken into account, and then it is advantageous to keep the conductors as close as possible by the avoidance of single-core cables. Voltage drop in cables under all conditions can be calculated by the following formulæ:—

Voltage drop in cabling $= 3\,I\,(R\cos\phi \pm X\sin\phi)$ for three-phase load and $2\,I\,(R\cos\phi \pm X\sin\phi)$ for single-phase load.

The sign is positive for lagging power factor and negative for leading power factor when

I = current in amperes

R = resistance of one line in ohms

*X = reactance in ohms $= \dfrac{2\pi f L}{1{,}000}$ ohms per mile

$\cos\phi$ = power factor

f = frequency of supply in cycles/sec

L = inductance in millihenries per mile

$= 0{\cdot}0854 + 0{\cdot}0741 \log \dfrac{d}{r}$ millihenries per mile

d = distance between centres of conductors in inches

r = radius of one conductor in inches

*For a multicore cable, this can be obtained from standard cables.

The electrical load throughout Britain has in the past doubled roughly every seven years, and that rate of progress is continuing at the present time. The resultant increase in capacity of power stations, substations, cables,

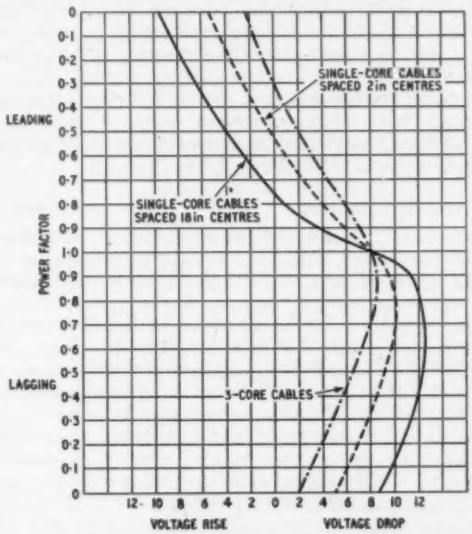


Fig. 5.—Relationship between power factor and voltage drop in a cable (curves illustrate the effect on a 1 sq in conductor carrying 200 A over 100 yd)

etc., makes available a very much greater current to feed into any fault which may occur in a factory installation. This is something which the electrical engineer must watch with great care if accident and fire risks are to be minimised.

Twenty-five years ago, total power station capacity was a fraction of what it is today, and at that time very little thought was given to the subject of rupturing capacity within the factory itself. Much of the switchgear offered for sale at that time had not been properly tested to ascertain its guaranteed performance, and has since proved to be completely inadequate for modern requirements. This is a subject which has, of course, been closely studied by the Inspector of Factories and wherever he is aware of the need for change, recommendations are made

to the management to take some steps to improve rupturing capacity either by a complete replacement of switchgear or by backing up what exists with h.r.c. fuses.

To calculate fault current on a system is comparatively complicated, for one must take into account many factors such as the fault level on the supply transformer terminals, reactance of transformers and cables, etc., within the factory. As a very rough and ready rule, rupturing capacity of substation switchgear can be deduced from the size of transformers feeding it, assuming these to be immediately adjacent to the switchgear. Taking their reactance figure as five per cent (which is average) then the power available at the l.v. switchgear in the event of a short circuit within the substation could be

$$\frac{\text{Transformer capacity in kVA} \times 100}{5} \text{kVA}$$

The result gives a figure that is on the safe side. Modern 440 V switchgear usually has a rupturing capacity of from 15 to 40 MVA, depending on the design. It will be seen that, for example, if 25 MVA switchgear is used it should not be fed by transformers aggregating more than 1,250 kVA on the basis of the approximate formula quoted above. It is often necessary to split boards up into sections and to have them interconnected by bus couplers which can readily be interlocked with the transformer breakers to avoid all the transformers being connected to the busbars simultaneously.

On the other hand, when the supply is distributed throughout the factory, equipment installed in other parts which may be remote from the substation will have long interconnecting cables whose impedance will limit the fault current on short circuit, and often it may be possible to install, with safety, switchgear having a much lower rupturing capacity than is necessary in the substation adjacent to the transformers.

Private Generation

Before 1939 when there was an abundance of coal and power the supply authority invariably discouraged the use of private generation, and if the consumer installed any type whatsoever it was common for the authority's electricity supplies to be charged as a standby, and the tariff raised unduly on that account. However, that position has changed, owing to some extent to the shortage of coal and power station capacity of a few years ago.

Where process steam is needed in a factory, it is, of course, often advantageous and economical to consider back-pressure or pass-out steam turbines to generate electricity, and the supply authority will usually be happy to negotiate parallel operation with this sort of supply if it helps the consumer. In some circumstances they will agree to a two-way exchange of power, particularly if it can be exported from the consumer's terminals during peak hours.

Diesel generators were very frequently installed, due to shortage of power from the grid, to minimise inconvenience and loss of production in the event of power cuts or load shedding. In some cases such units are used more or less continuously, and here again the authorities often allow them to be put in parallel with their supply. The curve shown in Fig. 6 illustrates the approximate cost of generation by diesel engine for varying load factors. This figure shows that separate generation is generally uncompetitive with the electricity supply unless the diesel generator set can be fully loaded almost continuously.

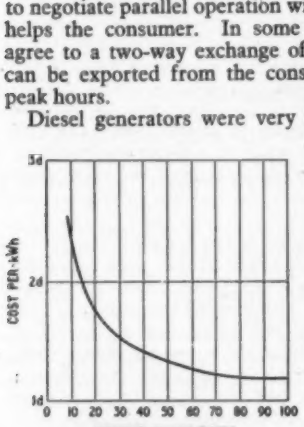


Fig. 6.—Cost of generating electricity in the factory by diesel generator

Types of Motors

The squirrel-cage motor is the commonest type of electric motor in use, but for many applications its constant speed, low starting torque and high starting current make it unsuitable, and either some other a.c. motor or a d.c. motor is required.

A crude form of speed variation can be obtained with the slip-ring induction motor by inserting resistances in its rotor circuit. This reduces the torque output from the motor and, provided the load torque is constant, pulls down the speed of the motor. This method is, of course, very inefficient because of the heat loss in the resistances. Furthermore, if the load torque is lost, the motor immediately accelerates to its maximum speed. In a recent adaptation of this drive both these objections have been overcome. The rotor power of the machine is rectified and fed into a d.c. motor either coupled to the same shaft or separately driven. This means the losses otherwise occurring in the rotor resistances are converted to useful power, and the speed rise when the load is removed is limited to the regulation of the d.c. machine circuit, which virtually means that it runs at constant speed. Speed ranges up to 2:1 can be economic with this arrangement. This scheme has become attractive since the development of the semiconductor type of power rectifiers, namely, the germanium and silicon rectifiers. These rectifiers are very much more efficient, and occupy much less space, than the equivalent mercury arc or metal rectifiers. Special techniques are required in the manufacture of these rectifiers to ensure the high degree of purity of the germanium and silicon crystals. These problems have now been largely solved, and rectifiers of this type are available for general industrial use.

In recent years the majority of d.c. motors installed in industry have been supplied by their own d.c. generator or rectifier. Drives of this nature range from a few h.p. to the largest motors made for rolling mills, paper machines, mine winders, rubber calenders and research and test plant drives.

The popularity of the individual d.c. motor-generator loop, known as the Ward Leonard drive, is due to the ready way in which this fits in with modern high-accuracy speed and torque controls. Where speed constancy over a wide range of torque control or rapid acceleration and deceleration are required, the Ward Leonard drive is the most easily adapted. Magnetic amplifiers are now widely used for control of these drives. They have the same reliability as air-cooled transformers, and therefore are superior to rotating amplifiers and electronic circuits in that they are free from components having a limited life, bearings, commutators or rotating parts. This makes them particularly attractive for control schemes on continuous production plants such as rolling mills, paper machines, etc. Failures in magnetic amplifiers are almost unknown, and maintenance is confined to routine testing. They form the basis of the so-called "contactorless" controls because it is possible to incorporate them into a circuit so that they behave like an on/off switch. This

application is likely to grow in the future to replace contactors used in schemes where frequent operation is required.

With the steady development of mercury-arc rectifiers of the pumpless steel tank type, and more reliable forms of grid control, increasing attention is being given to using these rectifiers to supply variable-speed d.c. motors from the a.c. supply, thereby replacing the motor-generator set. The advantage of this is the smaller space, lower weight and simpler foundations of the rectifier. The main difficulty with a rectifier-fed d.c. motor arises when it is desired to regeneratively brake the motor. This is inherently possible with a Ward Leonard drive, but with a rectifier it is necessary either to reverse the motor field or reverse the armature connections and switch the grid control to inversion. In spite of this difficulty suitable equipment has been developed, and the scheme is being applied to rolling mill drives, mine winders and hoists. This development has been more rapid on the Continent, possibly due to the greater latitude which the Continental supply companies allow their consumers in generating harmonic currents. Grid-controlled rectifiers generate undesirable harmonic currents which may interfere with other users if the rectifier load is a large percentage of the total load.

Electric Heating

Electricity is most easily converted into heat, and it will be worth while to consider some ways of heating useful to industry. There are two forms of high-frequency heating, induction and dielectric.

Induction heating consists in producing an alternating magnetic field which causes hysteresis and eddy-current losses in a magnetic material, or eddy-current losses only in a non-magnetic material. If the material is magnetic the frequency can be relatively low, say 50 c/s to 10 kc/s. In the case of non-magnetic materials a higher frequency is required, between 250 kc/s and 1 Mc/s. In both cases the material must be a conductor of electricity to allow the eddy currents to flow. The lower frequency ranges are used for melting, hardening or tempering the ferrous and non-ferrous metals. If it is desired to harden a thin skin of the metal a high frequency is used which confines the eddy currents to the outer layers of the metal. The skin depth is a function of the permeability of the material and inversely proportional to the square root of the frequency. The advantages of this method of heating are, of course, that the heat is generated exactly where it is wanted, so that the heat losses are small, and rapid efficient heating is obtainable.

In dielectric heating an alternating electric field is applied to a non-conducting material which has a high dielectric loss. A higher frequency, around 150 Mc/s, is required for this. The advantage is again that the heat is generated inside the material. These materials are generally poor conductors of heat, so that extremely high surface temperatures would be necessary if more conventional heating methods were adopted. Dielectric heating can be used for annealing rayon and nylon, bonding plywood and plastics, curing rubber, etc.

Space heating by electricity was at one time regarded as expensive and wasteful. In recent years, however, considerable attention has been given to the possibilities of electric floor heating which, when combined with heat storage, can take advantage of lower tariffs and show both greater comfort levels and savings in heating costs. The floor warming of industrial and domestic premises can become an off-peak load by using the concrete floor slab as a heat storage sink. Electricity is generally supplied from 7 p.m. to 7 a.m. and for a two-hour boost period around lunchtime.

It is a well-known fact that for the same comfort level less heat energy must be supplied to a room if it is uniformly applied through the floor than if it is fed through radiators or convectors. The first cost of an electric floor heating installation is very much lower than that of oil-fired boilers and water or steam radiators and pipes. The result is that the total cost per annum of electric floor heating is generally appreciably less than that of steam or hot water heating.

Conclusion

The use of electricity in industry is still expanding rapidly. With the advent of nuclear power stations the supply of electrical energy will be assured in the future. The automatic control of machines and factories will come, in the interests of more efficient production, and in this direction probably lie the most spectacular developments of the future in the application of electrical engineering to industry.

THE FUTURE OF TELECOMMUNICATIONS

AT the conclusion of the annual general meeting of the Institution of Electrical Engineers on 14th May, Professor E. C. Cherry, who, the President said, had established an international reputation in the field of communication theory, gave a lecture on "The Conceivable Future of Telecommunications." Since the last war, he said, the boundaries of the subject had exploded, and it was now being studied in the universities in a way incomparably broader in concept than in the 'thirties. Telecommunication was a social rather than a technical subject and should be treated and taught as such. It involved economic, political and psychological considerations and was not intelligible if studied solely as a technology.

In the West, the full automation of the telephone system in this country and in Europe was rapidly coming about and the possibility of direct dialling contact with North America must be studied. Developments in global communication were most likely where there were kinship and language connections. Some people postulated the application of automatic translation to telephone systems, but a more probable development was a rapidly accessible bureau of human translators which could be connected on demand.

Both cable and wireless would probably continue to be used, since they were complementary and one could do what the other could not. Much interesting work had been done on tropospheric and ionospheric scattering. Scattering from meteor trails had received some attention and might be used for the transmission of data stored until a convenient meteor came along. Within the next year or so it should be possible to use artificial satellites for repeaters, going round at the same rate as the earth's rotation and hovering over the Atlantic. They could be used in connection with transatlantic television, or, more usefully, the transmission of data. Data transmission would be very important in the future.

Short-wave radio relay links had come to stay and would be intensively developed for overland routes. In

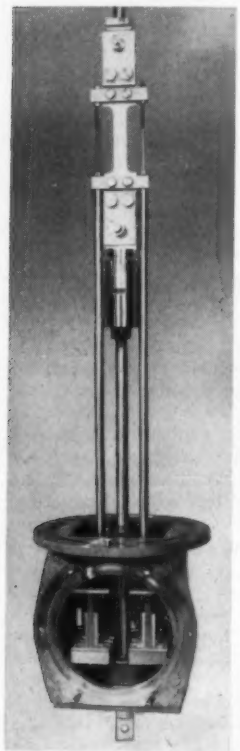
this country, the dense concentrations of industrial population could be readily connected by trunk routes of circular waveguides alongside railways and trunk roads. Cable would continue to be used for transocean routes and would continue to increase in bandwidth. Transmission would be of the pulse type, using discrete signals.

The cost of a telecommunication system was enormous and could be economic only if the utmost use was made of its capacity. Wider bands must be obtained in submarine cables by placing repeaters closer together and, with so much apparatus on the sea bed, research would have to be concentrated on reliability. There would be a separate network for control, which would communicate test signals for finding and changing routes automatically and storing data about the state of the system. The control data for the kind of system which he visualised would not be concentrated in exchanges but be scattered over the network, so that the telephone exchange as such would disappear, being dispersed over a whole region. The whole signalling network would become one vast exchange.

There were two general approaches to the compression of speech channels: (i) the type, of which the Vocoder was an example, in which the parameters were fixed, and (ii) the parametric system, which aimed to extract from speech the essential clues of the movement of the articulators, the variation of the parameters constituting the transmission. Systems with fixed parameters produced distortion, whereas there was a hope that variable parameter systems would produce not distortion but an accent, because the carrier was not independent of the speech but related to it.

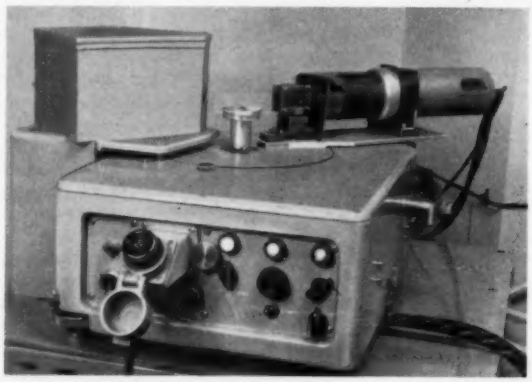
LABORATORY FOR NON-FERROUS METALS

THE first new laboratory block which the British Non-Ferrous Metals Research Association has been able to build since the war was opened last week by Sir Alexander Fleck at Euston Street, London. The main features of the new block are a much enlarged foundry, corrosion and physics laboratories and an electro-plating shop. Alterations have also been made to the existing building and this has enabled a new creep testing laboratory to accommodate over 100 creep frames. In this laboratory, research on creep and fatigue of lead cable sheathing alloys is being carried out and a newly-designed equipment for creep testing thorium, zirconium, etc., in atmospheres of purified argon is being installed. The former mechanical testing laboratory has been converted into a fatigue laboratory and more space has been allotted to apparatus for the determination of gases in metals. Two vibraphore direct stressing fatigue machines, one of ten tons capacity and the other of two tons capacity, are now in use.



Part of a creep testing apparatus developed by the laboratories. Tests on thorium and zirconium specimens are carried out in an argon atmosphere

Much of the laboratory's work on the newer metals is now connected with the nuclear power industry. One laboratory is set aside for an investigation into the metallurgy of thorium and its alloys, the object being to produce thorium-based materials having adequate strength at high temperatures to be used as nuclear power fuel elements.



X-ray spectrometer built in the workshop for research on X-ray fluorescence analysis

Further work is being carried out in the electro-plating shop on an instrument for measuring the thickness of electro-deposited coatings. This instrument utilises the variation in the thermo-electric potential developed when a heated probe is applied to plated coatings, mainly nickel plating.

Determination of the zinc content of brass with an accuracy at least as good as routine chemical analyses is being carried out on an X-ray spectrometer in the physics laboratory. The method is akin to spectrographic analysis but, instead of sparking the metal and examining the light spectrum produced, the metal is irradiated with a beam of X-rays and the X-ray fluorescence is split into a spectrum and analysed by means of scintillation counters. A prototype of a commercial instrument is on loan to the laboratory from Solartron for evaluation. This instrument is designed to carry out the complete analysis of alloys and automatically record the results on a paper tape.

I.E.E. Special General Meeting

A special general meeting of corporate members of the Institution of Electrical Engineers will be held on 25th June (5.30 p.m.) at the Institution of Civil Engineers, Great George Street, London, S.W.1, to consider two resolutions passed by the Council of the Institution on 23rd April regarding increases in entrance fees and annual subscriptions.

Power from Underground Gasification

A 3·75 MW power station is now operating from gas produced at the underground gasification project developed by Humphreys & Glasgow, Ltd., for the National Coal Board at Newman Spinney, near Chesterfield. Work on this project is due to end on 30th June, following a recent decision by the National Coal Board, whose opinion was that further expenditure on it was not justified as far as the fuel needs of this country were concerned.

An entirely new system is being used. A shaft was sunk to the coal seam and a gallery driven horizontally. From this gallery boreholes were drilled within the coal seam for distances up to 450ft. The drilling of these boreholes itself represented a considerable achievement, since the seam is only 27in thick and the holes are 14in in diameter. Vertical holes were drilled from the surface to intersect the horizontal boreholes at the ends remote from the gallery.

Another notable achievement was in making accurate intersection between these vertical holes and the horizontal holes 200ft below them. Novel techniques to achieve this included the use of a remote reading compass for surveying the horizontal boreholes, developed in association with the Admiralty Compass Observatory. Radioactive isotopes were also used to assist in making these intersections.

Other boreholes were drilled from the surface to intersect the gallery for primary admission of air to the system. Secondary air inlet boreholes were also prepared to be brought into use if required as gasification proceeded. When the system was completed ignition was started in the gallery. This was brought about by "bonfires" of coal and timber ignited electrically from the surface.

Air blown down the boreholes into the gallery brings about a gasification reaction. The gases travel along the boreholes within the seam and back to the surface via the vertical uptakes, and thence by means of surface mains to the power station built by the Central Electricity Generating Board.

The gas is cooled by the direct injection of water, supplemented by surface cooling of the mains. These simple methods, while suitable for a pilot plant which is due to work only for a short time, would, on a commercial plant, be replaced by conventional gas cooling equipment.

Air for gasification is supplied by electrically-driven blowers, which are situated in a building adjacent to the power station for convenience of control, and the air is taken to the field by mains which run parallel to the returning gas main.

The gas approaching the power station can, if required, be passed through a booster. The gas produced by this means is of low calorific value and at present is considered only as a source of power. It is burned in a boiler of special design, to raise steam which is fed to an old Brush-Ljungstrom turbine which had been removed from Kettering power station.

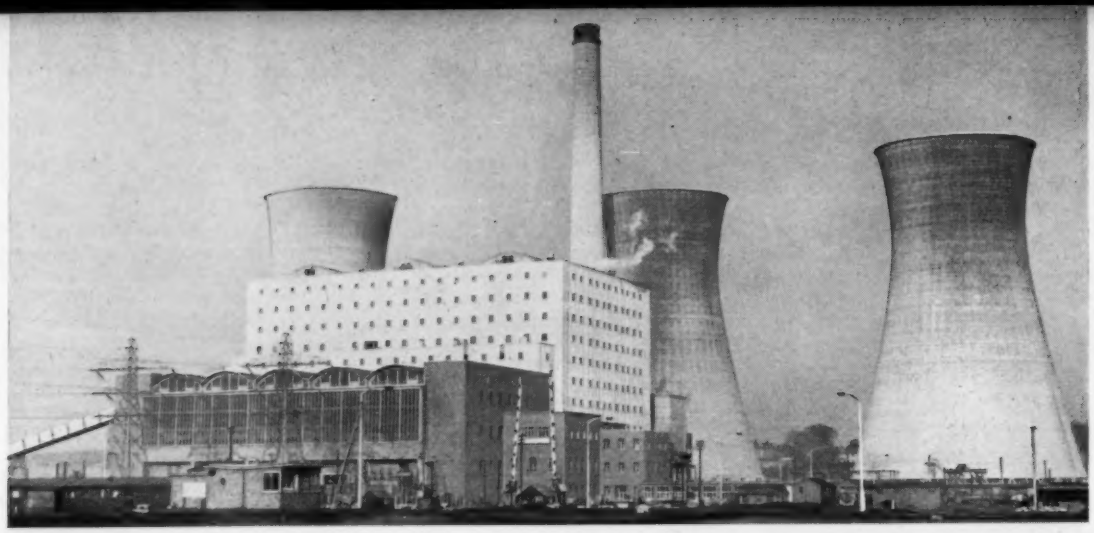
A wide range of indicating and recording instruments are provided for close and accurate control of every stage of the process.

Flameproof Motors

THE scope of the revised B.S. 741:1959 on flameproof motors for use in mines covers constructional requirements, by reference to B.S. 229, "Flameproof enclosure of electrical apparatus," and electrical performance. The latter includes limits of permissible temperature rise, performance under momentary overloads and at high voltage, and commutation, efficiency and power factor. Procedures for routine, performance and type tests are specified.

There are many changes from the previous Standard published in 1937. The table of permissible temperature rise values has been extended. This now deals separately with a.c. and d.c. machines, and three further classes of insulating material have been introduced. The table now covers classes A, E, B, F and H. Increases have been made in the actual values of permissible temperature rise for the main components, and a maximum rise figure is now given for the motor surface. Tolerances are specified on the manufacturer's stated values for efficiency and power factor, routine tests have been introduced as standard acceptance procedure in conjunction with type tests or, alternatively, with performance tests carried out on a sampling basis, and the limitation on voltage supply has been withdrawn. The standard also gives particulars required on making inquiry or when ordering.

Copies may be obtained from the British Standards Institution, 2, Park Street, London, W.1, price 5s.



Ferrybridge "B" power station, which will contain three 100 MW units

Generation in Great Britain

AS in 1953, 1955 and 1957 we once again this year publish in time for the British Electrical Power Convention a schedule and a map specially designed to show at a glance the positions and major operating figures of all the power stations in England, Scotland and Wales. For each power station a reference number links the symbol on the map and statistics in the schedules. This has been prepared with the co-operation of the Central Electricity Generating Board, the North of Scotland Hydro-Electric Board, and the South of Scotland Electricity Board, so as to present a complete picture of the generating position at the end of 1958.

QUICK REFERENCE MAP AND PLANT PERFORMANCE SCHEDULE

The map indicates the situation of the stations in commission and those under construction or planned. Features revealed by this latest survey are the greatly increased capacity of the newer generating sets and the closing down of a large number of smaller sets.

Because of the greatly increased size of sets in the newest stations and the special significance of this in terms of increased temperature and pressure, we have reclassified the highest class and the opportunity has been taken to get a better balance throughout.

Generation Statistics

The total number of power station sites scheduled as in operation by all three authorities at the end of 1958 was 284, including 216 owned and operated by the C.E.G.B. as compared with 236 at the end of 1956. Truer comparative figures, however, are afforded by the total installed capacity of generating plant of the C.E.G.B. stations—25,369 MW in 1958 as compared with 22,400 MW in 1956.

The C.E.G.B. stations with the largest plant capacity (1958) were Castle Donington (500 MW), Marchwood (420 MW) and Fulham, Staythorpe "A," Uskmouth, Keadby, Skelton Grange, Clarence Dock, Tilbury "A" and Hams Hall "C," all of 360 MW capacity. With the exception of Fulham and Clarence Dock these are all post-war stations. This time only one station, Chagford (26 kW), with a capacity of less than 100 kW, is shown; the other two of the three smallest stations are Downton (117 kW) and Ringwood (147 kW).

The total maximum output capacity of all C.E.G.B. stations this time is 23,319 MW, while the electricity supplied from all the C.E.G.B. stations is given as 84,855 million kWh, as compared with 75,159 million kWh last time. The following is an outline of other major statistics for C.E.G.B. stations in 1958:—Average load percentage of maximum output capacity of all stations 42·77; net electricity supplied to the South of Scotland Board 468 million kWh; electricity purchased from other sources 346 million kWh; total fuel consumed by all stations 45·6 million tons; pulverised fuel consumed as proportion of total coal burnt 65·74 per cent, as compared with 57·37 per cent last time (1956); overall thermal efficiency of all steam stations 25·99 per cent, as compared with 24·7 per cent.

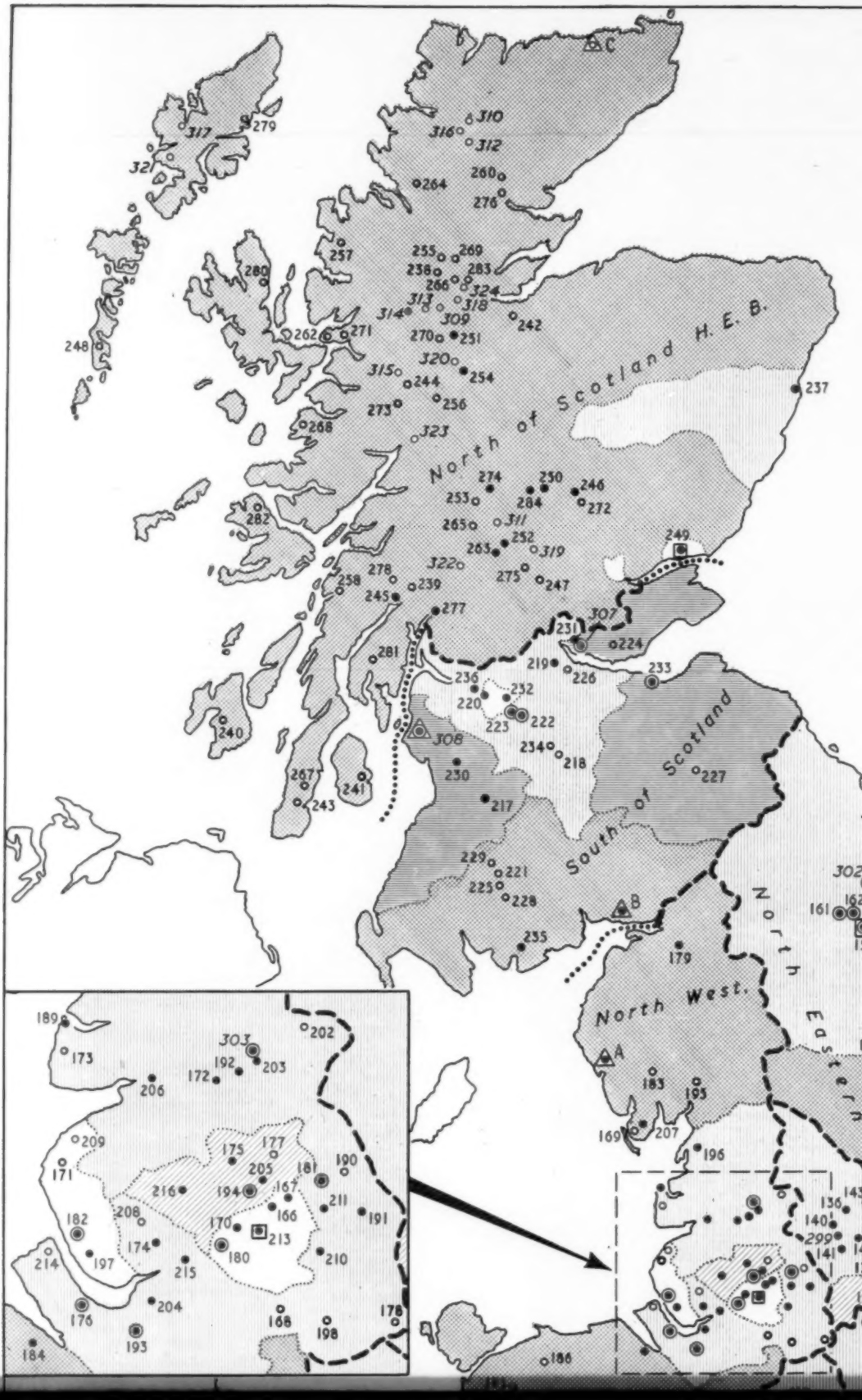
Higher Thermal Efficiencies

The ten individual C.E.G.B. stations with the highest thermal efficiencies are Castle Donington 32·91 per cent; Ferrybridge "B" 31·2 per cent; Drakelow "A" 30·84 per cent; Willington "A" 30·76 per cent; Stourport "B" H.P. 30·31 per cent; Meaford "B" 30·22 per cent; Wakefield "B" 30·12 per cent; Stourport "B" L.P. 30·09 per cent; Rogerstone 30·03 per cent; and Marchwood 30·02 per cent.

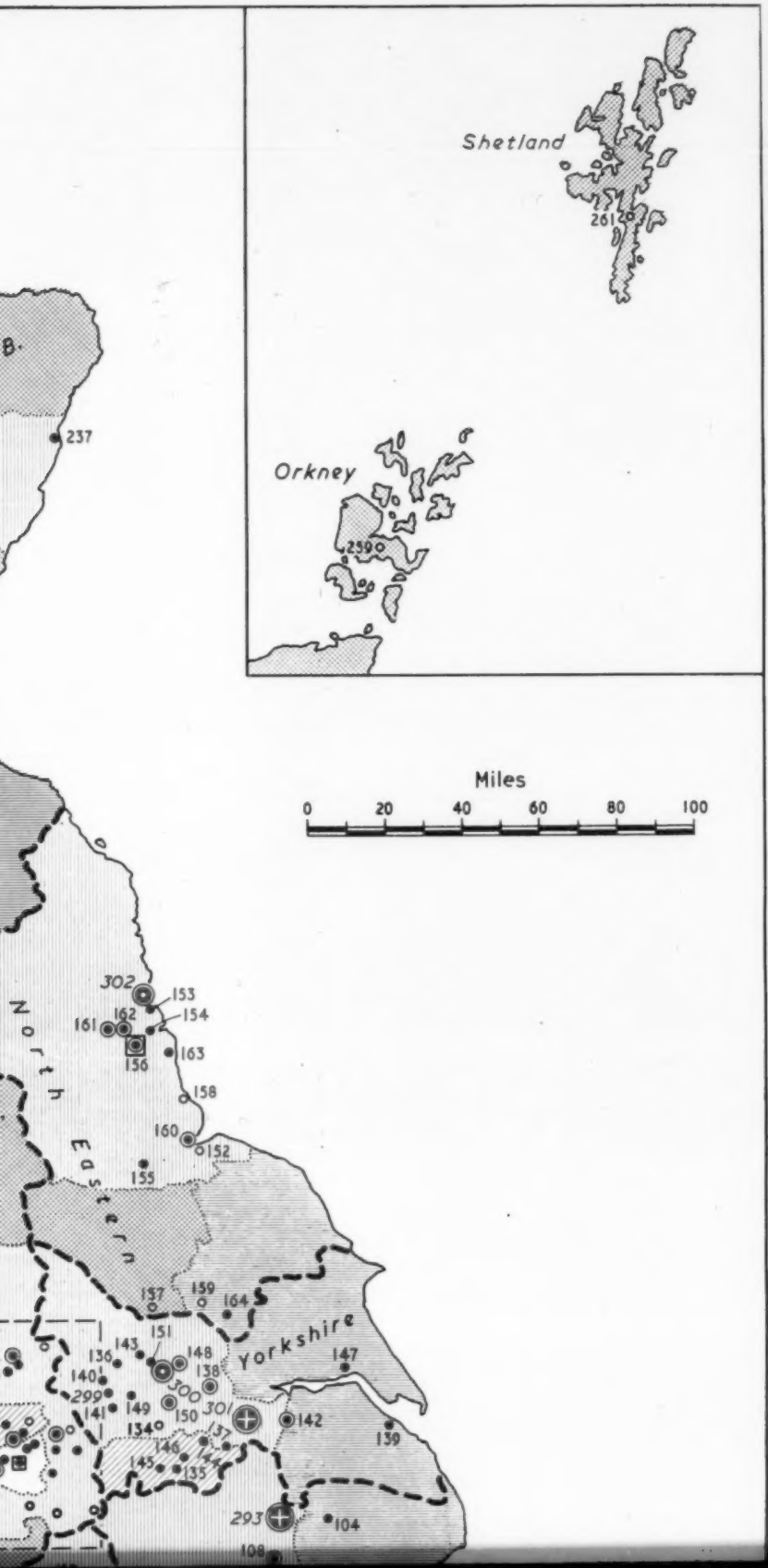
The stations with the highest steam conditions are Brimsdown "A" 1,900 p.s.i., 930 deg F; Brimsdown "B" H.P. 1,900 p.s.i., 930 deg F; Castle Donington, Drakelow "A," Meaford "B," Stourport "B" H.P. and Willington "A" 1,500 p.s.i. and 1,050 deg F; Blyth "A" 1,500 p.s.i., 1,000 deg F; and Ferrybridge "B" 1,500 p.s.i. and 975 deg F. The stations with the highest outputs during 1958 were Castle Donington 3,029 million kWh; Skelton Grange 2,613 million kWh; and Keadby 2,304 million kWh.

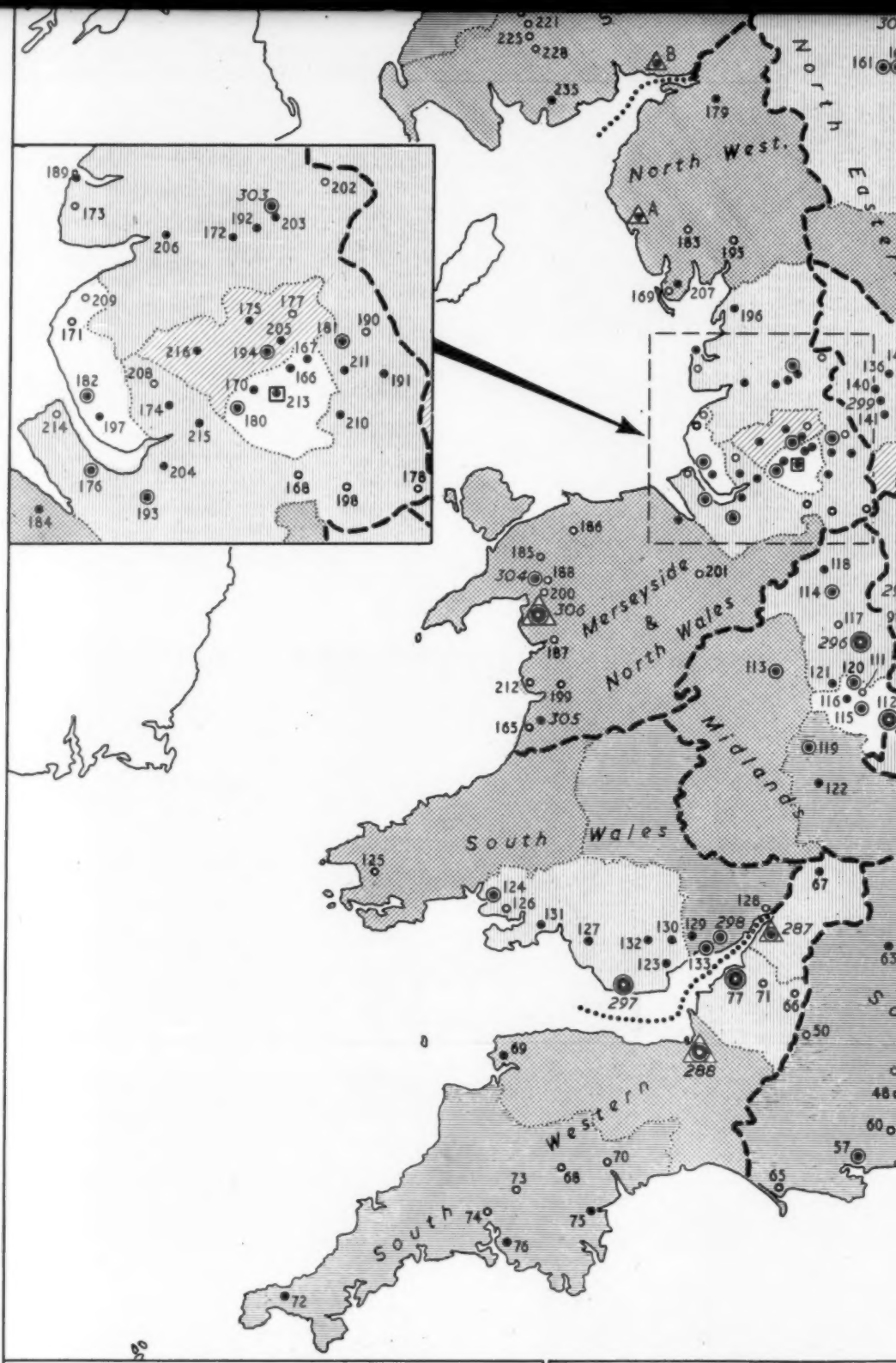
The 27 new stations under construction or planned in the C.E.G.B. programme up to 1963 have a designed installed capacity of 12,312 MW.

GENERATION IN GREAT BRITAIN. Map showing Power Stations in



Stations in operation and under construction or planned





GENERATING STATIONS

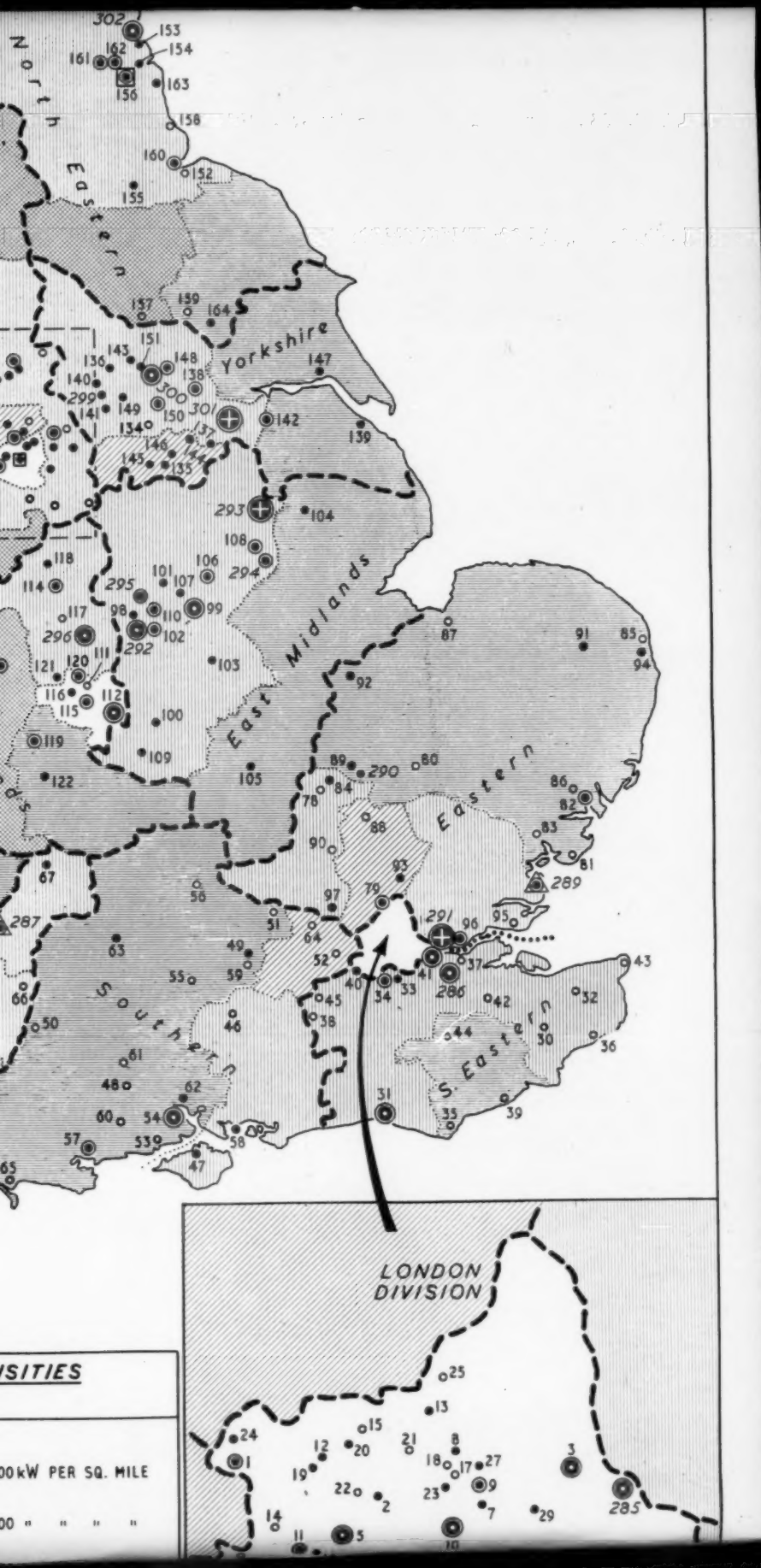
IN OPERATION

PRIME MOVER	UNDER 30MW	30–200	201–400	401–999	1,000MW & OVER
S — STEAM	○ 50	•	◉	◉	
NS — NUCLEAR STEAM		▲			
I — INTERNAL COMBUSTION	○ 125				

LOAD DENSITIES

ABOVE 2,000 kW PER SQ. MI

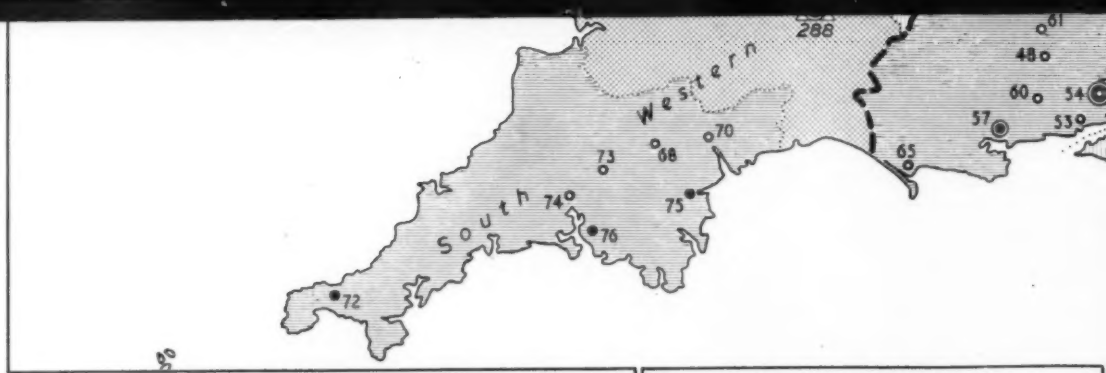
1,001 — 2,000 " " "



VSITIES

00kW PER SQ. MILE

00 " " " "



GENERATING STATIONS

IN OPERATION

PRIME MOVER	UNDER 30MW	30–200	201–400	401–999	1,000MW & OVER
S — STEAM	○ 50	●	◉	◎	
NS — NUCLEAR STEAM		⧋			
I — INTERNAL COMBUSTION	○ 125				
H — HYDRO	○ 188	●			
S(I)	○ 59				
I(H)	○ 212				
H(I)	○ 187				
SG — STEAM & GAS TURBINE		▣	▣		

STATIONS UNDER CONSTRUCTION OR PLANNED

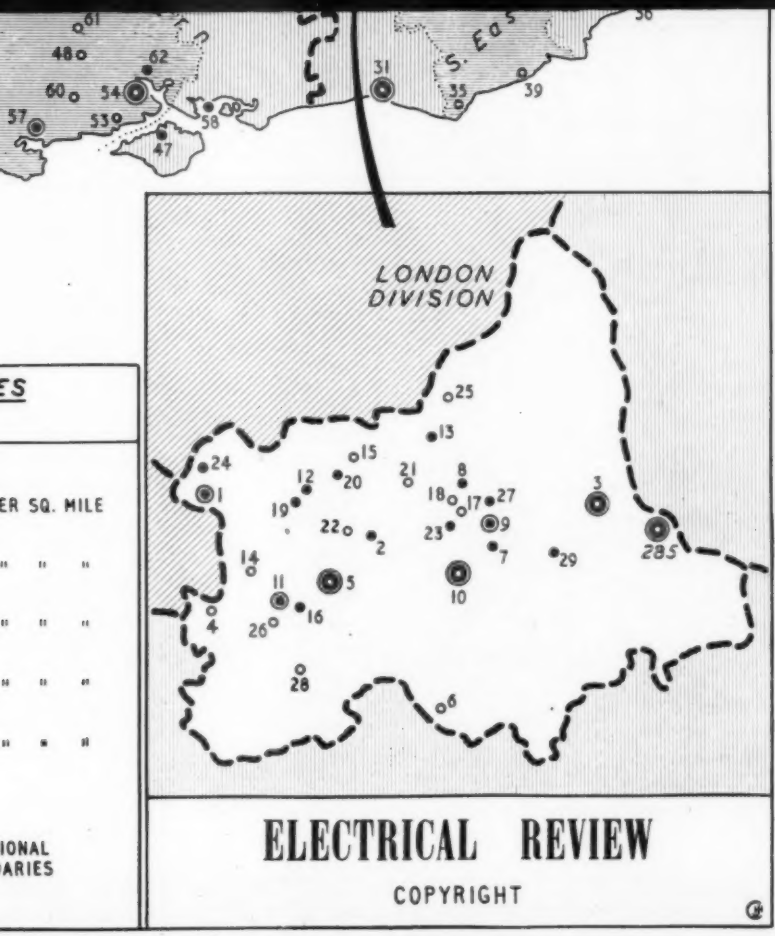
WITH APPROPRIATE COLOURED NUMBERING	○	⧋	●	⧋	◉	⧋	◎	⧋	⊕

LOAD DENSITIES

- ABOVE 2,000 kW PER SQ. MILE
- 1,001 — 2,000 " " " "
- 251 — 1,000 " " " "
- 80 — 250 " " " "
- BELOW 80 " " " "

DIVISIONAL BOUNDARIES

GENERATION IN GREAT BRITAIN—This map has been specially prepared by the *ELECTRICAL REVIEW*, in the South of Scotland Electricity Board and the North of Scotland Hydro-Electric Board, to provide "at a Britain. It brings up-to-date the similar maps which were published in the *ELECTRICAL REVIEW*'s British El 1955, and 5th June, 1953



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ER SQ. MILE

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IONAL
DARIES

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Map Ref.	
1	A
2	B
3	B
4	B
5	B
6	B
7	B
8	B
9	B
10	C
	C
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26	C
27	C
28	C
29	C
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31	C
32	C
33	C
34	C
35	C
36	C
37	C
38	C
39	C
40	C

SCHEDULE OF POWER STATIONS AS AT 31st DECEMBER, 1958

Map Ref.	Name of Station	Type of Prime Mover	Type of Cooling	Method of Fuel Delivery	Total Installed Capacity of Generators—MW	Extensions Planned or under Construction—Gen. Sets—MW	Steam Gen. Sets 30 MW and above; Hydro above 10 MW	Total Boiler Capacity—klb/hr; million cu ft for hydro storage	Boilers 100 klb/hr and above; gross head in ft for hydro	Steam Conditions at Turbine Stop Valves p.s.i.	Steam Conditions at Turbine Stop Valves deg F	Type of Firing	Year of Commissioning of Oldest Existing Set	Generating Voltage—kV	Electricity Supplied from Station, 1958—Million kWh	Overall Thermal Efficiency, 1958—Per Cent	Time Generating, 1958—Hours	Fuel Consumed (all types) Thousand Tons
	Central Electricity Generating Board																	
	LONDON DIVISION																	
1	Acton Lane 'A'	S	T	R	30·000	—	1×30	440	4×110	600	850	CG	1946	22·0	29·694	18·33	1,676	24·1
		S(I)	T	R	50·145	—	—	960	—	250	650/700	CG	1927	6·6	7·033	5·12	695	20·4
	'B	S	T	R	150·000	—	5×30	1,680	7×240	600	850	CG	1954	11·6	514·791	24·89	7,058	307·7
2	Bankside 'A'	S	R	S	64·000	—	—	850	—	180/250	464/600	OF, CG	1913	11·0	13·660	11·73	1,003	13·6
	'B'	S	R	S	120·000	1×120	2×60	1,500	4×375	900	900	OF	1952	15·0	524·319	27·94	7,234	115·7
3	Barking 'A'	S	R	S	218·750	—	4×40	1,900	10×150	350	700	PF, CG	1925	6·6	42·754	9·73	1,613	64·0
	'B'	S	R	S	303·500	—	4×75	4,032	8×248 8×256	600	800	CG	1933	12·5	1,121·358	24·17	8,760	674·5
	'C'	S	R	S	232·500	—	3×77·5	2,565	5×405 1×540	900	925	PF/OF, PF	1952	12·5	1,276·780	28·35	8,760	492·1
4	Barnes	S	R	S.B.	6·500	—	—	80	—	190/195	600/650	CG	1922	6·0	0·343	5·45	113	0·9
5	Battersea 'A'	S	R	S	245·700	—	2×69 1×105	2,400	6×250 3×300	600	800/850	RS/PF, RS	1933	11·0	566·784	22·47	8,212	301·4
	'B	S	R	S	266·000	—	2×100 1×60	3,350	2×400 6×425	1,350	750/950	RS/PF, PF	1941	11·0	1,078·878	28·36	8,645	520·3
6	Beckenham	S	R.T.	R.Rd.	4·750	—	—	49	—	155	650	CG	1913	2·0, 3·0	0·110	3·78	57	0·4
7	Blackwall Point	S	R	S	90·000	—	3×30	1,095	3×365	600	850	PF	1951	11·0	344·506	26·98	6,377	185·4
8	Bow	S	R	R	51·500	—	—	785	—	250	650	CG	1921	11·0	8·390	10·37	1,115	11·2
9	Brunswick Wharf	S	R	S	346·000	—	4×55 2×63	3,520	11×320	900	900	PF	1952	11·8	1,633·251	28·33	8,760	834·7
10	Deptford East H.P.	S	R	S.B.	165·000	—	3×55	1,700	2×225 5×250	900	900	CG	1953	11·8	933·626	27·92	8,579	467·2
	L.P.	S	R	S	70·000	—	—	750	—	300	675	CG, RS	1925	11·0	5·544	10·54	395	7·4
	Deptford West	S	R	S	222·000	—	2×30 3×35 1×50	2,486	4×110 1×160 3×176 2×264 1×220	350	750	CG, RS	1929	6·6, 22·0	400·378	18·44	5,812	301·8
11	Fulham	S(I)	R	S	360·100	—	6×60	4,600	8×315	600	800	RS	1936	11·0	1,626·192	25·25	8,760	809·9
12	Grove Road	S	T	R	80·250	—	—	895	—	210	675/700	CG	1921	6·6	55·294	13·13	2,573	63·8
13	Hackney 'A' H.P.	S	R	S.B.Rd	70·000	—	2×30	750	5×150	370	780	CG, CG/OF	1923	6·6	17·328	11·58	1,007	21·9
	'A' L.P.	S		S.B.Rd	21·000	—	—	264	—	200	540	CG	1917	6·6				
	'B'	S	R.T.	R.B.	96·000	—	2×33 1×30	900	3×300	600	850	PF	1954	7·3	221·690	26·20	6,186	122·0
14	Hammersmith	S	R	R.Rd.	20·000	—	—	229	—	195	650	CG, RS	1922	6·6	0·510	2·62	146	2·7
15	Islington	S	T	R	22·000	—	—	340	1×120	180	436/550	CG	1922	2·2, 6·6	0·816	3·65	269	2·7
16	Lombard Road	S	R	R.B.	50·000	—	1×30	510	2×125	190/300	520/750	CG, RS	1919	6·6	12·074	13·07	746	12·8
17	Poplar, Glaucus St	S	C	S.B.	15·000	—	—	195	—	185	486	CG, SS	1922	6·6	0·408	4·57	137	1·3
18	Poplar, Watts Grove	S	C.T.	—	25·000	—	—	288	—	300	665	CG	1927	6·6	0·783	3·31	173	3·4
19	St. Marylebone	S	C.T.	S.Rd.	38·600	—	—	300	—	190	550/600	CG	1913	6·6	−0·247	—	76	3·4
20	St. Pancras	S(I)	C	R.Rd.	47·566	—	—	220	—	200	600/686	CG, OF	1920	5·2	0·174	1·48	1,299	1·7
21	Shoreditch	S	C	S.B.	24·500	—	—	282	1×100	220	530/600	CG	1919	6·6	6·477	10·69	1,440	8·3
22	Shorts Gardens	I	—	—	2·800	—	—	—	—	—	—	—	1927	0·210	0·062	23·64	156	0·02
23	Stepney H.P.	S	R	S	53·000	—	1×34	705	3×150	350	750/860	CG, PF	1931	6·6	35·569	17·59	6,648	29·1
	L.P.	S	R	S	31·250	—	—	48	—	180	570	CG	1924	6·6				
24	Taylors Lane H.P.	S	T	R	64·000	—	2×32	750	5×150	1,350	955	CG	1943	33·0	118·959	21·40	4,288	83·9
	L.P.	S	T	R	11·500	—	—	130	—	190	650	PF	1929	11·0	1·063	8·47	234	1·9
25	Walthamstow	S	T	R	19·500	—	—	220	—	180	550/600	CG	1916	6·6	2·569	7·99	649	4·3
26	Wandsworth	S	R	S.B.	22·000	—	—	200	—	150	560/600	CG	1914	11·0	6·655	9·73	1,187	8·9
27	West Ham 'A'	S	T	S.B.	64·000	—	1×30	600	2×160	190/200	605/700	CG	1923	6·6	16·735	10·64	2,036	22·5
	'B'	S	T	R.B.	120·000	—	4×30	1,440	8×180	625	860	CG	1949	11·0	410·680	23·25	6,457	259·5
28	Wimbledon	S(I)	R	R.Rd.	25·200	—	—	222	—	150/245	500/660	CG	1909	2·0, 10·5	3·156	10·10	462	4·5
29	Woolwich H.P.	S	R	S	60·000	—	2×30	720	4×180	600	850	CG	1952	22·0	196·184	24·44	5,257	117·0
	I.P.	S(I)	R	S	104·250	—	3×34·5	990	6×165	400	800	CG	1940	22·0	104·073	19·55	2,807	77·8
	L.P.	S	R	S	12·500	—	—	140	—	190	600	CG	1928	6·6				
	SOUTH EASTERN DIVISION																	
30	Ashford 'A'	I	—	—	2·050	—	—	—	—	—	—	—	1926	6·6	0·549	24·98	361	0·2
	'B'	I	T	—	10·000	—	—	—	—	—	—	—	1954	6·76	21·665	32·74	3,693	5·3
31	Brighton 'A'	S	S	S	190·000	—	1×30 2×37·5 1×50	2,200	4×160 4×215 2×350	350/650	750/850	PF, CG, RS	1930	8·0, 11·0	249·789	20·64	4,989	161·6
	'B'	S	S	S	342·000	—	4×55·5 2×60	3,520	11×320	900	900	PF	1952	11/11·8 11·6	1,452·408	28·57	8,626	672·8
32	Canterbury	S	R	Rd.	4·375	—	—	30	—	200	500	CG	1922	6·6	0·383	8·39	312	0·6
33	Croydon 'A' H.P.	S	T	R	30·000	—	1×30	325	1×150 1×175	490	800	CG	1937	6·6	75·744	18·66	3,510	58·3
	'A L.P.	S			53·000	—	—	450	2×125	265	780/800	CG	1924	6·6				
	'B'	S	T	R	210·000	—	4×52·5	2,560	8×320	600	850	PF	1950	11·8	681·760	25·97	6,322	355·3
34	Eastbourne	S	T	R	9·000	—	—	110	—	250	650/630	CG	1923	2·2	1·229	7·35	404	2·1
35	Folkestone	S	T	R	7·125	—	—	56	—	200	550	CG	1922	6·6	0·787	8·99	364	1·1
36	Gravesend	S	W	S.B.	12·000	—	—	150	—	175/215	540	CG	1921	6·6	2·216	8·85	388	3·4
37	Guildford	S	R	R.Rd.	11·250	—	—	150	—	250	700	CG	1927	6·6	1·711	10·56	330	2·3
38	Hastings	S	T	R	14·250	—	—	187	—	250	650	CG	1923	6·6	2·505	10·40	331	2·9
39	Kingston 'A'	S	R	S.B.Rd	5·750	—	—	80	—	190/225	584/750	CG	1923	3·3	0·023	0·78	92	0·4
40	'B'	S	R	S.B.Rd	123·000	—	4×30	1,710	6×285	600	850	CG	1948	11·5	507·914	24·63	6,786	293·0

EXPLANATORY NOTES RELATING TO SCHEDULE

In the column giving the types of the prime movers the following code is used: S = steam; NS = nuclear steam; H = hydro; I = internal combustion; IH = combined internal combustion and hydro; SI = combined steam and internal combustion; SG = steam and gas turbine.
In the column giving the types of cooling the code is: T = tower; R = river; C = canal; W = well; S = sea; P = spray ponds.
In the column depicting the method of fuel delivery the code is: R = rail; Rd. = road; S = ship; B = barge.
The code for the types of firing is: CG = chain grate; HF = hand firing; OF = oil firing; RS = retort stoker; SS = spreader stoker; PF = pulverised fuel.

Map Ref.	Name of Station	Type of Prime Mover	Type of Cooling	Method of Fuel Delivery	Total Installed Capacity of Generators—MW	Extensions Planned or under Construction—Gen. Sets—MW	Steam Gen. Sets 30 MW and above; Hydro above 10 MW	Total Boiler Capacity—klb/hr; million cu ft for hydro storage	Boilers 100 klb/hr and above; gross head in ft for hydro	Steam Conditions at Turbine Stop Valves: p.s.i.	Steam Conditions at Turbine Stop Valves: deg F	Type of Firing	Year of Commissioning of Oldest Existing Set	Generating Voltage—kV	Electricity Supplied from Station, 1958—Million kWh	Overall Thermal Efficiency, 1958—Per Cent	Time Generating, 1958—Hours	Fuel Consumed (all types) Thousand Tons
	SOUTH EASTERN DIVISION (*continued*)																	
41	Littlebrook 'A'	S	R	S	120·000	—	2×30 1×60	1,530	6×255	600	800	CG, PF	1939	13·2, 15·0	74·612	18·35	1,714	59·6
	'B'	S	R	S	120·000	—	2×60	1,060	4×265	1,235	825	PF	1949	11·8	752·680	29·73	8,738	338·6
	'C'	S	R	S	240·000	—	4×60	2,520	7×360	900	900	PF/OF	1952	11·0	1,299·580	28·35	8,760	519·3
42	Maidstone	S	R.T.	S	13·125	—	—	150	—	220/225	630/700	CG	1908	6·6	2·715	10·75	591	3·3
43	Thanet	S	T	R	6·000	—	—	70	—	150/200	516/538	CG	1914	2·75	1·259	7·06	630	2·2
44	Tunbridge Wells	S	T	R	11·250	—	—	120	—	240/250	666	CG	1924	6·6	1·212	9·79	303	1·6
45	Woking	S	T	R.Rd.	7·000	—	—	65	—	175	650	CG	1918	2·0	—0·001	—	28	0·1
	SOUTHERN DIVISION																	
46	Basingstoke	I	—	—	2·470	—	—	—	—	—	—	—	1925	0·5, 11·0	0·691	25·92	437	0·2
47	Cowes H.P.	S	R	S	25·000	—	—	270	2×135	400	800	CG	1955	6·6	59·426	21·25	4,802	37·1
	L.P.	S	R	S	13·000	—	—	142·5	—	190	670/700	CG	1928	11·0	2·111	12·28	407	2·3
48	Downton	I(H)	—	—	0·117	—	—	—	—	—	—	—	1930	0·42	0·213	—	8,461	—
49	Earley	S	R	R	120·000	—	3×40	1,400	7×200	615	845	PF	1942	33·0	256·348	23·87	5,560	137·5
50	Frome	S	T	Rd.	2·350	—	—	37	—	160	600	CG	1902	6·6, 11·0	0·096	5·96	72	0·2
51	High Wycombe	S(I)	R	R.Rd.	3·960	—	—	52	—	155	600	CG	1912	6·6, 0·47	0·301	9·67	177	0·4
52	Hounslow	S	P	S.B.	2·350	—	—	37·5	—	200	550	CG	1924	0·5	0·462	8·25	248	0·8
	Hounslow	I	—	—	1·800	—	—	—	—	—	—	—	1948	0·4	0·571	29·27	348	0·2
53	Lymington	I	—	—	0·490	—	—	—	—	—	—	—	1929	0·4/0·44	0·024	21·38	58	—
54	Marchwood	S	R	S.Rd.	420·000	1×60	7×60	3,850	7×550	900	900	PF/OF	1955	11·8	2,257·229	30·02	8,749	628·6
55	Newbury	I	—	—	2·570	—	—	—	—	—	—	—	1924	0·5	0·817	31·44	431	0·2
56	Oxford	S	R	R.Rd.	22·500	—	—	250	—	240	650	CG, RS	1923	2·75, 11·0	8·728	11·72	1,392	10·6
57	Poole	S	S	S	330·000	—	4×52·5 2×60	2,720	8×340	900	925	PF, OF, PF/OF	1950	11·8	1,051·695	27·30	8,201	423·7
58	Portsmouth H.P.	S	S	S	120·000	—	4×30	1,455	2×135 5×165 2×180	600	850	CG	1938	11·0	357·820	22·95	6,237	208·8
	L.P.	S	S	S	20·000	—	—	276	—	245	700	CG	1927	6·6	3·084	13·27	365	3·1
59	Reading	S(I)	R	R.Rd.	10·700	—	—	160	—	160	550	CG	1923	3·75	0·861	8·66	182	1·3
60	Ringwood	I(H)	—	—	0·147	—	—	—	—	—	—	—	1925	0·42	0·371	—	8,687	—
61	Salisbury	S	R	R	2·900	—	—	49	—	185	650	CG	1925	6·6, 11·0	0·120	5·28	74	0·3
62	Southampton H.P.	S	S	S	50·000	—	—	576	3×192	400	800	CG	1936	6·6	46·087	17·02	2,592	35·6
	L.P.	S	S	S	38·000	—	—	280	—	200	750	CG	1922	6·6				
63	Swindon H.P.	S	T	R	20·000	—	—	240	2×120	400	800	CG	1943	6·6	31·367	16·25	2,907	27·3
	L.P.	S	T	R	15·000	—	—	120	—	270	700	CG	1927	6·6				
64	Uxbridge	S	C	S.B.	4·160	—	—	81	—	200	600	CG/HF	1900	6·6	0·203	2·95	109	1·0
65	Weymouth	S	S	R.Rd.	4·650	—	—	76	—	200	650	CG	1927	6·6	0·251	4·87	82	0·6
	SOUTH WESTERN DIVISION																	
66	Bath	S	R	Rd.	20·000	—	—	200	—	170/200	600	OF, CG	1921	6·6	9·728	12·28	1,345	10·4
67	Castle Meads	S(I)	R	R	40·075	—	—	500	5×100	400	800	CG	1942	11·0	133·479	23·58	5,278	78·8
68	Chagford	H	—	—	0·026	—	—	—	10	—	—	—	1916	0·4	0·096	—	7,177	—
69	East Yelland	S(I)	R	S	186·225	—	6×31	1,980	11×180	600	850	CG	1953	11·8, 0·4	773·225	25·76	7,023	366·1
70	Exeter	S	R.C.	R	12·000	—	—	131	—	195	566/586	CG	1925	2·2, 6·6	3·602	11·01	533	4·1
71	Feeder Road	S	C.T.	S.Rd.	25·778	1×60	—	150	—	200	530/600	CG	1901	6·6	—1·165	—	17	0·2
72	Hayle H.P.	S	S	S	55·000	—	—	600	2×100 2×200	400	800	CG	1947	11·0, 10·5	196·453	20·66	8,760	105·3
	L.P.	S	S	S	32·800	—	—	360	2×100	235	700/730	CG, PF	1928	11·0				
73	Marytavy	H(I)	—	—	3·988	—	—	—	230, 550	—	—	—	1928	0·42, 0·4	8·252	—	7,689	0·1
74	Morewellham	H	—	—	0·700	—	—	—	230	—	—	—	1934	0·42	4·397	—	8,623	—
75	Newton Abbot H.P.	S	R.T.	S.R.Rd	30·000	—	—	400	4×100	400	800	CG	1943	11·0	110·783	17·75	5,994	82·1
	L.P.	S	R.T.	S.R.Rd	15·000	—	—	166	—	250	700	CG	1928	11·0				
	L.P.	S	R	S.R.Rd	6·825	—	—	—	—	150	515	—	1902	11·0				
76	Plymouth 'A' H.P.	S	R	S	40·900	—	—	400	4×100	400	800	CG	1941	6·6	78·841	19·97	3,590	55·8
	'A' L.P.	S	R	S	24·800	—	—	160	—	190/200	550/588	CG	1925	6·6				
	'B' L.P.	S	R	S	99·000	—	3×33	960	3×320	600	875	PF, PF/OF	1951	33·0	400·783	29·46	7,262	197·5
77	Portishead 'A'	S	R	S	248·150	—	2×51·25 2×52	2,720	8×162·5 4×250	300	700/800	CG	1929	6·3, 11·0, 33·0	257·622	18·30	3,943	171·8
	'B'	S	R	S.R.	325·000	1×60	5×65	2,700	9×300	900	900	PF, OF	1955	11·8	1,545·979	29·84	8,749	744·3
	EASTERN DIVISION																	
78	Bedford	S	R	Rd.	12·500	—	—	141	—	190	650	CG	1929	6·6	1·619	9·65	251	2·7
79	Brimsdown 'A'	S	T	R	54·800	—	1×54·8	330	2×165	1,900	930	CG/PF	1937	33·0	74·002	21·78	4,623	43·6
	'B' H.P.	S	T	R	60·270	—	1×60·27	375	2×187·5	1,900	930	CC	1942	33·0	141·937	23·52	6,064	79·9
	'B' L.P.	S	T	R	60·000	—	1×60	680	2×340	900	900	PF	1955	11·8	176·063	27·86	4,604	89·3
	'B' L.P.	S	C.T.	R	107·500	—	—	1,250	4×200	315	680/750	OF, PF	1928	11·0, 33·0	99·704	16·43	3,721	76·9
80	Cambridge	S	R	Rd.	7·260	—	—	87	—	200	700	CG	1932	11·0, 6·6	0·476	9·13	124	0·7
81	Clacton	I	—	—	2·350	—	—	—	—	—	—	—	1921	0·5, 6·6, 11·0	0·206	20·45	248	0·1
82	Cliff Quay	S	R	S	276·000	—	6×46	3,285	9×365	600	825	PF	1949	11·8	1,072·314	26·08	8,760	603·6
83	Colchester	S	P	R	7·500	—	—	82	—	240	650	CG	1927	6·6	0·785	6·76	1,395	1·6
84	Goldington	S	R.T.	R	180·000	—	6×30	1,800	6×300	600	850	PF	1955	11·8	653·053	26·39	6,518	375·5
85	Great Yarmouth	S	R	S	11·250	—	—	108	1×108	250	650	CG	1926	6·6	1·312	8·95	284	2·0
86	Ipswich	S	R	R	17·250	—	—	162	—	250	640	CG	1919	6·6	0·411	4·88	1,360	1·4
87	Kings Lynn	S	R	R	5·250	—	—	75	—	200	625	CG	1921	6·6	0·303	6·92	110	0·6
88	Letchworth 'A'	S	T	R.Rd.	8·000	—	—	115	—	200	670	CG	1930	3·3	0·233	3·82	102	0·9
	'B'	S	T	R.Rd.	14·500	—	—	160	—	300	850	CG	1942	11·0	11·197	17·14	1,673	9·6
89	Little Barford 'A'	S	R.T.	R	120·000	—	4×30	1,200	4×300	650	900	PF	1941	11·0	226·741	24·23	4,819	140·0
90	Luton	S	T	R	23·000	—	—	180	—	160/200/300	650/700	PF	1920	6·6	20·805	13·00	2,291	22·9
91	Norwich H.P.	S	R	S	31·000	—	1×31	480	4×120	650	850	CG	1937	6·6	60·945	22·35	2,750	39·0
	L.P.	S	R	S	42·500	—	—	490	1×100	250	650/700	RS, CG	1922	6·6	13·956	13·39	1,017	15·0
92	Peterborough H.P.	S	R	R	40·000	—	—	480	3×160	400	800	PF	1951	11·0	97·761	22·87	4,751	64·5
	L.P.	S	R	R	18·000	—	—	210	—	230	650/700	PF	1928	6·6	1·235	5·05	200	3·7
93	Rye House	S	R.T.	R	128·000	—	4×32	1,400	4×350	600	850	PF	1951	33·0	224·139	24·04	3,997	144·4
94	South Denes	S	R	S	120·000	2×60	2×60	1,100	2×550	900	900	OF	1957	11·8	593·757	29·40	7,886	156·3
95	Southend (London Rd.)	I(S)	—	—	6·700	—	—	7·8	—	160	—	*	1921	0·55/0·5, 11·0	0·858	23·72	238	0·3
96	Tilbury 'A'	S	R	S	360·000	—	6×60	3,240	6×540	900	900	OF, PF/OF	1956	11·8	1,902·591	29·97	8,687	690·4
97	Watford	S	R.T.	Rd.	33·250	—	—	300	1×100	250	750	CG	1923	6·6	22·830	18·22	2,587	20·3

* Diesel exhaust gases.

Map Ref.	Name of Station	Type of Prime Mover	Type of Cooling	Method of Fuel Delivery	Total Installed Capacity of Generators—MW	Extensions Planned or under Construction—Gen. Sets—MW	Steam Gen. Sets 30 MW and above; Hydro above 10 MW	Total Boiler Capacity—klb/hr; million cu ft for hydro storage	Boilers 100 klb/hr and above; gross head in ft for hydro	Steam Conditions at Turbine Stop Valves p.s.i.	Steam Conditions at Turbine Stop Valves deg F	Type of Firing	Year of Commissioning of Oldest Existing Set	Generating Voltage—kV	Electricity Supplied from Station, 1958—Million kWh	Overall Thermal Efficiency, 1958—Per Cent	Time Generating, 1958—Hours	Fuel Consumed (all types) Thousand Tons
	EAST MIDLANDS DIVISION																	
98	Burton H.P.	S	R	Rd.	30·000	—	—	320	—	350	780	CG	1941	11·0	69·600	20·31	3,342	52·3
	L.P.	S	R	Rd.	13·500	—	—	216	—	190/200	620	CG	1924	3·3				
99	Castle Donington	S	R.T.	R.Rd.	500·000	1×100	5×100	4,150	5×830	1,500	1,050	PF	1956	13·8	3,029·459	32·91	8,760	1,472·3
100	Coventry 'A' & 'B'	S	T	R.Rd.	130·750	—	3×30·75	1,308	6×150	300	700	CG	1928	6·6, 33·0	121·113	17·36	3,305	104·0
101	Derby	S	R	Rd.	65·500	—	1×30	695	4×110	170/300	520/750	PF	1922	6·6, 33·0	119·363	20·24	4,056	94·3
102	Drakelow 'A'	S	R.T.	R.Rd.	240·000	—	4×60	2,060	4×515	1,500	1,050	PF	1954	11·8	1,445·228	30·84	8,388	725·3
103	Leicester H.P.	S	R.T.	R.Rd.	63·000	—	2×31·5	700	4×175	650	800	PF	1949	13·2	221·518	24·53	5,224	149·0
	L.P.	S	R.T.	R.Rd.	75·250	—	1×30	885	{3×120 3×175	250/350	700/750	PF	1928	6·6, 33·0	47·955	15·96	2,031	50·0
104	Lincoln	S	R.T.	R.Rd.	80·000	—	—	960	8×120	400	800	CG	1947	6·6	58·753	19·05	3,879	46·1
105	Northampton H.P.	S	R	R.Rd.	30·000	—	1×30	300	2×150	600	850	CG	1956	11·8	—	—	—	—
	I.P.	S	R.T.	R.Rd.	90·000	—	3×30	950	{4×150 2×175	400	800	CG	1936	33·0	240·044	22·39	5,761	166·0
	L.P.	S	R	R.Rd.	22·500	—	—	210	—	200	645/675	CG	1926	6·6				
106	Nottingham H.P.	S	R	R	60·000	—	1×60	600	2×300	900	900	PF	1957	11·8	324·418	27·32	8,008	195·4
	L.P.	S	R	R	254·000	—	{3×30 1×52·5 1×53	2,580	{4×150 4×175 4×320	250/600	650/850	PF	1925	11·0, 33·0	822·063	23·12	8,006	577·7
107	Spondon	S	R.T.	R.Rd.	172·000	—	4×30	1,840	6×160	215/350	685/750	CG	1925	6·6, 11·0	497·241	20·77	8,280	356·6
108	Staythorpe 'A'	S	R	R.Rd.	360·000	—	6×60	3,840	16×240	900	900	SS	1950	15·0	1,989·158	27·31	8,441	1,150·7
109	Warwick	S	R	Rd.	42·000	—	—	340	—	250/350	650/750	CG	1924	6·6, 12·0	37·610	15·98	3,475	37·0
110	Willington 'A'	S	R	R.Rd.	300·000	1×100	3×100	2,490	3×830	1,500	1,050	PF	1957	13·8	339·676	30·76	4,375	169·3
	MIDLANDS DIVISION																	
111	Birchills	S	C	Rd.	17·500	—	—	—	—	290	740	—	1922	6·6	1·770	11·67	464	2·6
112	Hams Hall 'A'	S	T	R.Rd.	254·250	—	{3×32 3×51·5	3,150	{5×180 9×250	350	700/730	PF, CG	1929	11·0	63·624	14·75	1,243	70·1
	'B'	S	T	R.Rd.	321·000	—	6×53·5	3,570	{6×275 6×320	650	825	PF	1942	33·0, 11·6	1,023·435	25·76	6,444	638·1
	'C'	S	T	R.Rd.	360·000	—	6×60	3,300	6×550	900	900	PF	1956	11·8	2,028·082	29·52	8,755	1,155·2
113	Ironbridge	S	R	R.Rd.	210·000	—	4×52·5	2,525	{3×225 2×250 5×270	375	750	PF, CG	1933	9·5, 33·0	237·069	19·36	3,581	194·9
114	Meaford 'A'	S	T	R.Rd.	120·000	—	4×30	1,440	6×240	600	825	PF	1948	11·8	414·061	24·35	6,033	235·1
	'B'	S	T	R	240·000	—	4×60	2,060	4×515	1,500	1,050	PF	1955	11·0, 11·8	1,536·190	30·22	8,760	747·2
115	Nechells 'A'	S	T	R.Rd.B	117·750	—	—	694	1×150	300	700	PF, CG	1922	11·0	— 1·377	—	103	5·6
	'B'	S	T	R.Rd.	210·000	—	4×52·5	2,760	12×230	650	825	CG	1951	11·0	710·123	23·30	7,095	490·3
116	Ocker Hill 'A'	S	T	R.Rd.B	128·000	—	{2×30 2×34	1,600	8×200	600	850	CG	1947	33·0, 11·8	286·761	23·14	4,559	212·5
117	Stafford	S	R	Rd.	6·000	—	—	107	—	170	520/525	CG	1925	6·6	—0·179	—	7	0·1
118	Stoke	S	T	Rd.	31·000	—	—	360	—	200/250	640/650	CG	1919	6·6	1·625	6·45	258	3·3
119	Stourport 'A' H.P.	S	R	R	125·000	—	{1×35 3×30	1,280	8×160	625	825	CG	1931	11·0	299·601	21·29	5,125	220·2
	'A' L.P.	S	R	R.Rd.	57·250	—	—	580	2×100	325	675	CG,RS	1926	33·0, 11·0	4·168	7·21	257	7·9
	'B' H.P.	S	R	R	60·000	—	1×60	515	1×515	1,500	1,050	PF	1954	11·8	276·385	30·31	5,246	147·0
	'B' L.P.	S	R	R	60·000	—	1×60	525	1×525	1,250	950	PF	1950	11·8	369 894	30 09	6,868	198 0
120	Walsall	S(I)	T	R.B.Rd	204·000	—	6×34	2,400	12×200	600	850	CG	1949	33·0	753 574	24·55	8,048	520·6
121	Wolverhampton	S	T	B	30·000	—	1×30	480	4×120	420	825	CG	1942	6·6	64·129	20·16	2,767	52·6
122	Worcester H.P.	S	R	R	30·000	—	—	450	3×150	400	800	CG	1943	6·6	32·003	19·44	2,313	25·3
	L.P.	S	R	R	10·500	—	—	—	—	200/215	590	—	1918	6·6				
	SOUTH WALES DIVISION																	
123	Cardiff H.P.	S	R.T.	R	60·000	—	2×30	720	4×180	600	850	CG	1942	33·0	48·511	18·95	2,690	33·1
	L.P.	S	R.T.	R	27·600	—	—	280	—	200	588/600	CG	1905	6·6	1·330	7·17	199	2·3
124	Carmarthen Bay	S	S	R	345·000	—	{2×52·5 4×60	3,600	15×240	900	900	PF	1953	11·8	2,159·336	28·42	8,708	968·5
125	Haverfordwest	I	—	—	8·465	—	—	—	—	—	—	—	1931	11·0	3·073	29·20	685	0·8
126	Llanelly	S	S	R	25·000	—	—	280	—	250	650/700	CG	1923	6·6	8 560	13·94	817	7 2
127	Llynfi	S	T	—	120·000	—	4×30	1,200	4×300	650	900	PF	1943	11·0	459·439	24 09	8,700	245·4
128	Lydney	S	R.T.	Rd.	17·500	—	—	155	—	250	650	CG	1923	6·6	6 351	11·56	1,155	8·0
129	Newport H.P.	S	R	R	60·000	—	2×30	660	{2×150 2×180	600	850	CG	1941	6·2/11·8	151·392	23·90	4,653	79·7
	L.P.	S	R	R	20·500	—	—	220	—	250	650	CG	1925	6·2	3 389	7·23	637	6·1
130	Rogerstone	S	T	R	120·000	—	2×60	1,100	2×550	900	900	PF	1957	11·8	700·484	30·03	7,874	323·7
131	Tir John	S	S	R	155·500	—	{2×30 2×41·5	1,880	{4×230 4×240	250/600	795/825	PF	1931	6·6, 33·0	652·935	17·29	8,760	505·9
132	Upper Boat H.P.	S	R.T.	R	90·000	—	3×30	1,274	{5×182 1×364	625	825	PF, CG/PF	1939	11·0, 33·0	206·987	20·35	4,587	134·5
	L.P.	S	R.T.	R	65·000	—	—	480	—	325	725	CG	1924	11·0, 33·0	11·986	7·61	821	20.7
133	Uskmouth 'A'	S	R	R	360·000	—	6×60	4,320	12×360	900	900	PF	1952	11·8	1,937·954	27·94	8,658	1,018·0
	YORKSHIRE DIVISION																	
134	Barugh	I	—	—	4·000	—	—	—	—	—	—	—	1954	10·0/11·0	4·307	32·59	1,513	1·0
135	Blackburn Meadows	S	T	R.Rd.B	185·000	—	{2×30 2×50	2,120	{3×100 9×160 2×190	580	800	CG, RS	1932	11·4, 11·0/11·6	511·351	20·83	7,438	349·0
136	Bradford H.P.	S	T	R.Rd.	75·000	—	1×30	1,080	6×180	625	825	CG, RS	1942	6·6, 33·0	112·836	20·08	4,247	77·3
	L.P.	S	T	R.Rd.	50·000	—	1×30	—	—	190	659/754	—	1925	6·6				
137	Doncaster 'B'	S	R	B.Rd.	120·000	—	4×30	1,440	8×180	600	850	CG	1953	11·8	293·197	24·20	7,358	172·7
138	Ferrybridge 'A' H.P.	S	R	R.Rd.B	130·000	—	{2×42·5 1×45	1,840	{8×130 4×200	600	825/850	CG	1939	10·5	449·308	22·21	6,893	289·2
	L.P.	S	R	R.Rd.B	40·000	—	—	456	—	275	650	CG	1927	10·8	16·255	12·27	1,643	17·9
	'B'	S	R.T.	R.Rd.B	200·000	1×100	2×100	1,520	2×760	1,500	975	PF	1957	13·8	455·389	31·20	4,445	218·8
139	Grimsby	S	T	R	38·000	—	—	425	—	200/225	590/800	CG	1924	6·6	107·184	24·98	6,339	88·2
140	Halifax H.P.	S	T	R.Rd.	38·300	—	—	420	{2×100 2×110	350	750/775	CG	1922	6·6	73·148	17·05	4,061	56·5
	L.P.	S	T	R.Rd.	10·000	—	—	—	—	200	640	—	1925	6·6				
141	Huddersfield H.P.	S	T	Rd.	60·000	—	2×30	720	4×180	600	850	CG	1953	11·8	371·955	25·49	7,895	194·9
	L.P.	S	T	Rd.	40·000	—	—	480	4×120	350	750	CG	1938	6·8	54·037	18·34	3,378	39·2
142	Keadby	S	R	R.Rd.	360·000	—	6×60	3,300	6×550	900	900	PF	1952	11·0, 11·8	2,304·469	27·66	8,715	1,307·0
143	Kirkstall H.P.	S	R.T.	R.Rd.B	60·000	—	2×30	750	3×250	600	850	PF	1947	33·0	231·343	23·39	6,670	150·9
	L.P.	S	R.T.	R.Rd.B	140·000	—	3×30	1,620	{3×160 3×180 3×200	450	720	PF	1930	11·0, 33·0	160·540	19·02	5,216	125·5

Map Ref.	Name of Station	Type of Prime Mover	Type of Cooling	Method of Fuel Delivery	Total Installed Capacity of Generators—MW	Extensions Planned or under Construction—Gen. Sets—MW	Steam Gen. Sets 30 MW and above; Hydro above 10 MW	Total Boiler Capacity—klb/hr; million cu ft for hydro storage	Boilers 100 klb/hr and above; gross head in ft for hydro	Steam Conditions at Turbine Stop Valves: p.s.i.	Steam Conditions at Turbine Stop Valves: deg F	Type of Firing	Year of Commissioning of Oldest Existing Set	Generating Voltage—kV	Electricity Supplied from Station, 1958—Million kWh	Overall Thermal Efficiency, 1958—Per Cent	Time Generating, 1958—Hours	Fuel Consumed (all types) Thousand Tons
	YORKSHIRE DIVISION *(continued)*																	
144	Mexborough	S	R.T.	R.Rd.	120·000	—	4×30	1,260	7×180	600	850	CG	1945	10·5	460·016	24·57	7,826	278·6
145	Neepsend	S	T	Rd.	160·000	—	2×30 2×50	1,940	5×160 6×190	600	825	CG	1936	11·4	539·541	21·69	7,166	353·6
146	Rotherham	S	R.C.T.	R.Rd.	160·000	—	2×30 1×50	1,800	10×180	600	850	CG, SS	1939	6·6, 11·0	454·142	22·46	7,716	292·1
147	Sculcoates (Hull)	S	T	R	122·000	—	2×30	1,492·5	5×110 3×187·5 2×190	240/375	600/800	CG	1925	6·6, 22·0	287·580	20·15	5,430	198·8
148	Skelton Grange 'A'	S	R.T.	R.Rd.	360·000	—	6×60	3,810	6×360 3×550	900	925	PF	1951	11·0	2,613·730	28·61	8,760	1,433·4
149	Thornhill	S	R.T.	Rd.B.	195·000	—	2×30 3×45	2,320	8×200	400	750/825	CG	1932	10·5	494·190	22·56	6,370	291·7
150	Wakefield 'B'	S	R.T.	Rd.	240·000	—	4×60	2,200	5×550	900	900	PF	1955	11·8	1,527 128	30·12	8,760	757·4
151	Whitehall Road	S	R	R	37·000	—	—	480	—	170	525	CG	1923	6·75	9·635	11·06	1,202	11·8
	NORTH EASTERN DIVISION																	
152	Ayresome	W*	—	—	3·000	—	—	—	—	130	350	—	1934	2·9	7·501	13·02	8,162	8·6
153	Blyth 'A'	S	R	R	120·000	3×120	1×120	860	1×860	1,500	1,000	PF	1958	13·8	—0·268	—	7	0·1
154	Carville	S	R	R	62·500	—	—	672	—	250	650	CG	1916	5·75	73·933	15·03	4,553	71·2
155	Darlington	S	T	R.Rd.	60·000	—	—	720	6×120	400	750	CG	1940	6·3	77·964	20·37	4,019	51·9
156	Dunston 'A'	S(G)	R	R.Rd.	60·000	—	—	509	—	190	600	CG	1920	5·75	0 080	14·30†	99	0·9
	'B' I	S	R	R	178·500	—	4×44	1,920	8×105 8×135	600	800	CG, PF	1932	13·5	464·001	21·47	8,760	326·7
	'B' II	S	R	R	100·000	—	2×50	820	2×410	600	850	PF	1949	11·0	637·187	29·08	8,679	324·0
157	Harrogate H.P.	S	R.P.	Rd.	9·500	—	—	100	—	300	700	CG	1928	3·46, 11·0	5·145	14·32	1,105	5·0
	L.P.	S	R.P.	Rd.	6·375	—	—	24	—	175	600	—	1922	3·66				
158	Hordan	W*	T	—	6·000	—	—	80	—	250	650	GF	1934	2·75	23·271	15·12	8,757	23·0
159	Linton Lock (York)	H	—	—	0·750	—	—	—	12	—	—	—	1923	6·6	1·603	—	4,581	—
160	North Tees 'A' & 'B'	S	R	S	110·000	—	—	1,330	2×180	450	650/700	CG/PF	1921	11·5	55·685	14·36	2,760	58·3
	'C'	S	R	S	240·000	—	4×60	2,520	7×360	900	925	PF	1951	11·0	1,123·136	28·60	8,760	601·0
161	Stella North	S	T	R.Rd.	240·000	—	4×60	2,200	4×550	900	900	PF	1955	11·8	1,137·409	29·30	8,760	584·9
162	South	S	R	R.Rd.	300·000	—	5×60	2,750	5×550	900	900	PF	1954	11·8	1,608·416	29·99	8,760	803·6
163	Sunderland H.P.	S	T	R	40·000	—	—	363	3×121	400	800	CG	1942	5·25	98·630	17·46	5,371	76·9
	L.P.	S	T	R	20·000	—	—	300	—	250	650	CG	1925	5·0/5·3				
164	York (Foss Is.)	S	R.T.	R	40·000	—	—	400	4×100	400	750/800	CG	1941	11·0	23·867	18·40	1,781	17·7
							* Waste heat plant.			Gas turbine plant.								
	NORTH WEST, MERSEYSIDE AND NORTH WALES DIVISION																	
165	Aberystwyth	I	—	—	4·920	—	—	—	—	—	—	—	1915	6·6	9·480	30·97	6,551	2·4
166	Agecroft 'A'	S	R	R.Rd.	58·100	—	—	550	—	300	700	CG	1924	6·6	15·533	15·74	1, 08	14·5
167	'B' L.P.	S	T	R	110·000	—	2×55	1,260	4×315	600	850	PF	1950	33·0	626·238	27·09	8,262	334·6
168	Alderley Edge	I	—	—	4·000	—	—	—	—	—	—	—	1954	11·0	1·149	34·73	304	0·3
169	Barrow	S	T	R	23·000	—	—	175	—	195	550/650	CG	1914	6·6	23·749	15·47	3,664	19·4
170	Barton	S	C	B	161·500	—	1×41 1×51·5	1,685	2×125 1×130 1×140 2×200	350	700/825	CG, PF	1923	6·6, 33·0	335·711	17·55	6,626	258·1
171	Birkdale	I	—	—	0·500	—	—	—	—	—	—	—	1924	0·48/0·55	0·007	—	—	—
172	Blackburn	S	T	R.B.	158·000	—	1×32 3×42	1,800	12×150	600	850	CG	1942	33·0	340·192	22·48	5,559	203·5
173	Blackpool (Steam)	S	T	Rd.	12·300	—	—	76	—	245	600/650	CG, RS	1923	6·6	0·162	—	—	0·5
	Blackpool (Diesel)	I	—	—	6·400	—	—	—	—	—	—	—	1954	6·6	0·001	15·51	1	—
174	Bold 'A'	S	T	C	120·000	—	4×30	1,200	4×300	600	850	PF	1953	11·8	688·429	26·52	8,720	349·8
	'B'	S	T	C	60 000	2×60	1×60	550	1×550	900	900	PF	1958	11·8	13 974	26·56	390	6 9
175	Bolton	S	R.P.T	R	107 500	—	3×31·25	990	6×165	200/400	538/800	CG	1923	6·6, 11·5	131·090	19·63	4,244	89·3
176	Bromborough	S	R	R	210·000	—	4×52·5	2,400	8×300	900	900	PF/OF	1951	11·0	379·252	28·04	8,711	379·3
177	Bury H.P.	S	R.T.	R	10·000	—	—	120	—	300	700	CG	1930	6·6	8·934	14·93	1,616	8·0
	L.P.	S	R.T.	R	16·000	—	—	100	—	200	580	CG	1921	6·6				
178	Buxton	I	—	—	4·000	—	—	—	—	—	—	—	1954	6·6	0·379	33·48	134	0·1
179	Carlisle H.P.	S	R	R.Rd.	60·750	—	2×30	750	5×150	600	825	CG	1943	11·0	199·8 2	20·71	7,128	114·5
	L.P.	S	R	R.Rd.	26·150	—	—	125	—	250	650	CG	1923	3·3, 11·0	3·006	6·74	620	5·8
180	Carrington	S	R	R.Rd.	256 000	—	4×64	2,520	7×360	900	900	PF	1953	11·8	1,201·372	28·29	8,382	654·4
181	Chadderton 'A'	S	T	R	41·250	—	—	400	—	250	650	CG	1929	6·6	1·251	8·23	178	2·2
	'B'	S	T	R.Rd.	240·000	—	4×60	2,520	7×360	900	900	PF	1953	11·8	996·630	27·39	8,195	515·9
182	Clarence Dock H.P.	S	R	R.Rd.	257·500	—	5×51·5	2,960	6×200 1×250 2×280 2×300 1×350	600	800	CG, PF	1937	33·0	925·866	23·59	8,323	588·5
	Clarence Dock L.P.	S	R	R.Rd.	102·500	—	2×51·25	1,440	4×200 4×160	400	750	CG	1931	7·25	181·703	19·08	3,837	181·7
183	Coniston	H	—	—	0·300	—	—	—	210	—	—	—	1932	0·48	0·875	—	7,943	—
184	Connah's Quay	S	T	R	180·000	—	6×30	1,800	6×300	600	850	PF	1953	11·8	1,005·868	27·65	8,679	507·6
185	Cwm Dyli	H	—	—	6·500	—	—	—	1,100	—	—	—	1906	10·0	10·042	—	3,949	—
186	Dolgarrog	H	—	—	27·700	—	1×10	—	1,130	—	—	—	1919	6·6	58·060	—	5,598	—
187	Dolgelly	H(I)	—	—	0·148	—	—	—	250	—	—	—	1934	0·4	0·435	—	7,9 4	4·3
188	Ffestiniog	H	—	—	0·589	2×75	—	—	170	—	—	—	1937	0·4	3·327	—	8,479	—
189	Fleetwood	S	T	R	90·000	—	3×30	900	3×300	600	850	PF	1955	11·8	441·655	26·35	8,591	251·4
190	Greenhill	S	T	R	17·200	—	—	145	—	200	560	CG	1921	6·3/6·6	9·561	11·57	1,912	11·7
191	Hartshead H.P.	S	T.P.	R.Rd.	94·250	—	1×31·25 2×31·5	1,050	7×150	615/620	830/840	CG	1939	6·6	283·925	23·29	5,848	173·3
	L.P.	S	T.P.	R.Rd.	37·500	—	—	280	—	275	675	CG	1931	6·6	9·378	11·74	839	11·1
192	Huncoat	S	T	R.Rd.	160·000	—	5×32	1,550	5×310	600	850	PF	1952	11·0	757·656	27·43	8,681	345·0
193	Ince	S	T	R.Rd.	260·000	—	4×65	2,200	4×550	900	900	PF/OF	1954	11·8	1,465·520	28·89	8,832	557·5
194	Kearsley H.P.	S	R.T.	R	207·200	—	2×51·6 2×52	2,560	16×160	600	800	CG, SS	1936	33·0	652·833	23·37	8,167	392·2
	L.P.	S	R.T.	R	64·875	—	2×32·25	760	—	300	675	CG	1929	11·0	10·182	15·09	412	9·3
195	Kendal	I	T	—	4·800	—	—	—	—	—	—	—	1928	6·3, 11·0	0·025	—	8	—
196	Lancaster H.P.	S	R	R.Rd.	41·600	—	—	410	2×205	400	800	CG	1942	6·6	86·375	22·87	4,250	50·0
	L.P.	S	R	R.Rd.	8·650	—	—	170	—	200	538	CG	1916	6·6				
197	Lister Drive	S	T	R	50·750	—	—	610	2×125	275	675	CG, PF	1926	6·3	20·238	12·00	1,314	25·6
198	Macclesfield	I	—	—	2·000	—	—	—	—	—	—	—	1955	11·0	0·573	34·31	309	0·1
199	Machynlleth 'A'	I(H)	—	—	0·250	—	—	—	—	—	—	—	1932	0·4, 0·42	0·324	—	4,348	—
	'B'	I	—	—	4·258	—	—	—	—	—	—	—	1956	6·6/6·0, 0·4	3·941	35·13	1,607	0·9

Map Ref.	Name of Station	Type of Prime Mover	Type of Cooling	Method of Fuel Delivery	Total Installed Capacity of Generators—MW	Extensions Planned or under Construction—Gen. Sets—MW	Steam Gen. Sets 30 MW and above; Hydro above 10 MW	Total Boiler Capacity—klb/hr; million cu ft for hydro storage	Boilers 100 klb/hr and above; gross head in ft for hydro	Steam Conditions at Turbine Stop Valves p.s.i.	Steam Conditions at Turbine Stop Valves deg F	Type of Firing	Year of Commissioning of Oldest Existing Set	Generating Voltage—kV	Electricity Supplied from Station, 1958—Million kWh	Overall Thermal Efficiency, 1958—Per cent	Time Generating, 1958—Hours	Fuel Consumed (all types) Thousand Tons
	NORTH WEST, MERSEYSIDE AND NORTH WALES DIVISION (*continued*)																	
200	Maentwrog	H	—	—	24·000	—	—	—	630	—	—	—	1928	6·6	47·025	—	5,408	—
201	Marchwiel	S(I)	T	R	12·410	—	—	200	—	230	630	CG	1941	11·0	2·176	9·84	520	3·0
202	Nelson	S	C	R.Rd.	12·750	—	—	59	—	190	550	CG	1922	6·6	—0·240	—	4	—
203	Padiham 'A'	S	R	R	31·375	—	—	322	—	240	550/620	CG	1926	11·0	9·476	14·76	1,192	8·7
204	Percival Lane 'A'	S	C	R	25·000	—	—	280	—	250	650	CG	1921	6·45	—0·533	—	20	0·5
	'B'	S	C	R	90·000	—	3×30	1,125	6×187·5	400	800	CG	1940	11·0	185·287	21·75	5,641	116·1
205	Radcliffe	S	R	R	53·550	—	—	400	—	150	500	CG	1904	11·0	30·397	12·88	2,863	30·9
206	Ribble 'A'	S	R	R.Rd.	55·100	—	—	402	—	300	700	CG	1924	6·6	—1·121	—	57	7·9
	'B'	S	R	R.Rd.	126·000	—	4×31·5	1,496	8×187	600	850	CG	1942	11·0	394·845	23·42	6,519	237·6
207	Roosecote	S	S	R	120·000	—	4×30	1,200	4×300	600	850	PF	1953	11·8	314·976	26·25	5,517	161·4
208	St. Helens	S	T	R	24·000	—	—	190	—	250	700	CG	1921	6·6	6·178	11·44	828	7·6
209	Southport	S	T	R	17·250	—	—	219	—	250	700	CG, OF	1921	6·6	15·948	14·71	2,605	13·8
210	Stockport H.P.	S	T	R.Rd.	30·000	—	1×30	300	1×300	600	825	PF	1943	6·6	91·181	22·87	4,338	54·2
	I.P.	S	R.T	R.Rd.	30·000	—	1×30	450	3×150	400	800	CG	1940	6·6	81·156	17·27	3,960	64·3
	L.P.	S		R.Rd.	32·500	—	—	85	—	210	630	CG	1926	6·6				
211	Stuart Street H.P.	S	T	B	61·500	—	1×61·5	800	2×400	600	850	PF	1949	33·0	407·186	26·64	7,904	207·4
	L.P.	S		B	118·250	—	3×30·75	1,500	2×100 / 10×130	350/355	700/780	CG	1936	6·6	244·484	19·25	5,390	177·7
212	Towyn	I(H)	—	—	0·950	—	—	—	50	—	—	—	1935	0·4	0·687	28·69	2,836	0·2
213	Trafford	S(G)	C	B	75·000	—	2×30	740	2×150 / 2×220	400	800	CG	1941	33·0	326·452	23·89*	8,024	186·9
214	Wallasey	S	R	Rd.	22·500	—	—	290	—	190	584/605	CG, PF, OF	1923	6·6	9·339	14·06	1,114	7·7
215	Warrington	S	R	R	90·000	—	1×30	1,000	5×200	400	800	CG	1942	6·6	244·594	21·75	7,658	158·0
216	Westwood	S	T	B.Rd.	128·000	—	4×32	1,500	5×300	600	850	PF	1951	11·0	554·600	24·05	7,982	337·8

* Steam plant.

South of Scotland Electricity Board

217	Barony	S	T	R	60·0	—	2×30	600	4×150	625	865	PF	1956	11·0	190·711	22·87	7,790	170·5
218	Bonnington	H	—	—	9·8	—	—	—	189	—	—	—	1927	11·0	55·478	—	8,745	—
219	Bonnybridge H.P.	S	T	R	40·0	—	—	480	4×120	350	750	CG	1944	22·0	185·001	20·89	8,258	132·9
	L.P.	S	T	R	25·0	—	—	150	—	250	650	CG	1923	6·6	32·439	14·60	3,513	32·6
220	Braehead	S	R	R.Rd.	200	1×60	4×50	2,100	7×300	900	900	PF	1951	11·0	1,304·672	28·55	8,760	678·7
221	Carsfad	H	—	—	12·0	—	—	30	65	—	—	—	1936	11·0	18·234	—	3,152	—
222	Clyde's Mill H.P.	S	R.T.	R	120·0	—	4×30	1,440	8×180	600	850	CG	1950	11·0	588·406	26·44	7,333	315·9
	I.P.	S	R	R	120·0	—	4×30	1,288	—	385	775	CG	1935	11·0	388·123	22·26	8,170	249·1
	L.P.	S	R	R	36·5	—	—	396	—	200	590	CG	1921	11·0	2·643	8·31	277	4·5
223	Dalmarnock H.P.	S	R	R.Rd.	120	—	2×60	1,200	6×200	900	900	CG	1956	11·8	796·230	30·09	8,317	373·5
	I.P.	S	R	R.Rd.	100·0	—	2×50	1,200	6×200	600	825	CG	1937	20·0	172·851	21·78	4,604	110·0
	L.P.	S	R	R.Rd.	37·5	—	—	560	—	270	700	CG	1926	6·5	—1·327	—	9	0·1
224	Dunfermline H.P.	S	R	R	12·5	—	—	160	—	290	690	CG	1957	6·6	6·165	13·73	681	6·5
	L.P.	S	R	R	13·0	—	—	100	—	160	500	CG	1919	6·6	0·326	5·31	129	0·9
225	Earlstoun	H	—	—	12·0	—	—	44	67	—	—	—	1936	11·0	21·821	—	3,201	—
226	Falkirk	S	T	Rd.	7·5	—	—	87	—	165/200	573/725	CG	1921	6·6	6·222	11·44	2,002	7·9
227	Galashiels	S	R	R	5·6	—	—	70	—	200	650	CG	1924	6·6	1·622	15·13	504	1·6
228	Glenlee	H	—	—	25·0	—	2×12	1,250	380	—	—	—	1935	11·0	46·720	—	2,585	—
229	Kendoon	H	—	—	21·0	—	2×10·5	40	150	—	—	—	1936	11·0	44·467	—	3,358	—
230	Kilmarnock	S	T	R	60·0	—	2×30	750	5×150	400	800	CG	1940	22·0	188·163	20·92	5,422	126·6
231	Kincardine	S	R	R.Rd.	120·0	2×120	1×120	860	1×860	1,500	1,000	PF	1958	13·8	—	—	—	—
232	Pinkston H.P.	S	T	R.Rd.	30·0	—	1×30	350	2×175	600	850	CG	1954	6·6	29·197*	22·25*	1,443*	17·8*
	L.P.	S	C	R.Rd.	35·0	—	—	425	—	300	700	CG	1923	6·6	1·796*	11·09*	301*	2·2*
233	Portobello H.P.	S	S	R.Rd.	180	—	3×60	1,620	3×540	1,350	950	PF	1951	13·2	1,096·302	30·81	8,760	523·4
	L.P.		S	R.Rd.	92·5	—	1×30 / 2×31·25	720	2×120	290	690	CG	1929	6·6	172·811	17·68	6,105	145·3
234	Stonebyres	H	—	—	5·7	—	—	—	97·5	—	—	—	1927	11·0	28·471	—	8,737	—
235	Tongland	H	—	—	33·0	—	3×11	30	106	—	—	—	1935	11·0	74·175	—	4,286	—
236	Yoker H.P.	S	R	R	60·0	—	2×30	720	—	385	780	CG	1937	11·0	280·032	23·28	7,620	175·2
	L.P.	S	R	R	40·0	—	—	480	—	220	675	CG	1929	11·0	47·499	15·40	2,720	44·3

* Pinkston was taken over from Glasgow Corporation by the South of Scotland Electricity Board on 1st November, 1958, and these figures relate to November and December only.

North of Scotland Hydro-Electric Board

237	Aberdeen	S	R	R	57·25	—	—	604	2	240	650	CG	1913	6·6	62·886	19·37	—	47·9
238	Achanalt	H	—	—	2·4	—	—	—	65	—	—	—	1956	11	6·951	—	—	—
239	Allt-na-Lairige	H	—	—	6·0	—	—	132	817	—	—	—	1956	11	14·420	—	—	—
240	Bowmore	I	—	S.Rd.	2·6	—	—	—	—	—	—	—	1948	0·415	4·852	—	—	1·3
241	Brodick	I(H)	—	B	2·9	—	—	—	700	—	—	—	1946	11, 0·415	hydro 0·513 diesel 5·630	—	—	1·3
242	Bught	H	—	—	0·1	—	—	—	12	—	—	—	1929	0·415	0·692	—	—	—
243	Campbeltown	I	—	B	3·1	—	—	—	—	—	—	—	1944	11, 3·3	3·219	—	—	0·8
244	Ceannacroc	H	—	—	20·0	—	1×20	8,720	296	—	—	—	1956	11	59·484	—	—	—
245	Clachan	H	—	—	40·0	—	1×40	750	965	—	—	—	1955	11	45·584	—	—	—
246	Clunie	H	—	—	61·2	—	3×20·4	173	173	—	—	—	1950	11	146·917	—	—	—
247	Dalchonzie	H	—	—	4·0	—	—	1,298	91	—	—	—	1958	3·3	4·859	—	—	—
248	Daliburgh	I	—	—	1·5	—	—	—	—	—	—	—	—	—	2·721	—	—	0·8
249	Dundee (Carolina Port)	S(G)	R	R.S.	88·0	—	2×30	812	6	180 / 325 / 600	700 / 750 / 850	CG, OF	1927	6·6, 11, 33	218·161	25·8	—	121·8
250	Errochty	H	—	—	75·0	—	3×25	—	610	—	—	—	1955	11	79·871	—	—	—
251	Fasnakyle	H	—	—	66·0	—	3×22	7,500	522	—	—	—	1951	11	208·941	—	—	—
252	Finlarig	H	—	—	30·0	—	1×30	460	1,362	—	—	—	1955	11	53·673	—	—	—
253	Gaur	H	—	—	6·4	—	—	—	92	—	—	—	1953	11, 0·415	15·821	—	—	—
254	Glen Moriston	H	—	—	36·0	—	2×18	8,720	306	—	—	—	1958	11	76·579	—	—	—
255	Grudie Bridge	H	—	—	24·0	—	2×12	—	537	—	—	—	1950	11	99·133	—	—	—
256	Invergarry	H	—	—	20·0	—	1×20	13,680	175	—	—	—	1956	11	73·390	—	—	—
257	Kerry Falls	H	—	—	1·25	—	—	—	185	—	—	—	1951	0·415	2·773	—	—	—
258	Kilmelfort	H	—	—	2·0	—	—	302	365	—	—	—	1956	11	9·171	—	—	—

Map Ref.	Name of Station	Type of Prime Mover	Type of Cooling	Method of Fuel Delivery	Total Installed Capacity of Generators—MW	Extensions Planned or under Construction—Gen. Sets—MW	Steam Gen. Sets 30 MW and above; Hydro above 10 MW	Total Boiler Capacity—klb/hr; million cu ft for hydro storage	Boilers 100 klb/hr and above; gross head in ft for hydro	Steam Conditions at Turbine Stop Valves p.s.i.	Steam Conditions at Turbine Stop Valves deg F	Type of Firing	Year of Commissioning of Oldest Existing Set	Generating Voltage—kV	Electricity Supplied from Station, 1958—Million kWh	Overall Thermal Efficiency, 1958—Per Cent	Time Generating, 1958—Hours	Fuel Consumed (all types) Thousand Tons
	NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD (*continued*)																	
259	Kirkwall	I	—	S	7·04	—	—	—	—	—	—	—	1950	11	14·598	—	—	3·4
260	*Lairg	H	—	—	3·5	—	—	11,350	26	—	—	—	1951	3·3	1·000	—	—	—
261	Lerwick	I	—	S	6·2	—	—	—	—	—	—	—	1952	11	12·627	—	—	3·0
262	Lochalsh	I	—	Rd.	0·91	—	—	—	—	—	—	—	1946	0·415	0·030	—	—	0·01
263	Lochay	H	—	—	45·0	—	2×22	4,468	592	—	—	—	1958	11	21·961	—	—	—
264	Loch Dubh	H	—	—	1·2	—	—	200	543	—	—	—	1954	0·415	4·295	—	—	—
265	Lubreoch	H	—	—	4·0	—	—	2,932	97	—	—	—	1958	3·3	2·59	—	—	—
266	Luichart	H	—	—	24·0	—	2×12	12,000	185	—	—	—	1954	11	115·191	—	—	—
267	Lussa	H	—	—	2·4	—	—	260	380	—	—	—	1952	11	8·837	—	—	—
268	Morar	H	—	—	0·75	—	—	—	16	—	—	—	1948	0·415	2·393	—	—	—
269	Mossford	H	—	—	24·00	—	2×12	2,580	529	—	—	—	1957	11	7·900	—	—	—
270	Mullardoch	H	—	—	2·40	—	—	6,730	90	—	—	—	1955	3·3	6·927	—	—	—
271	Nostie Bridge	H	—	—	1·25	—	—	—	490	—	—	—	1948	0·415	4·600	—	—	—
272	Pitlochry	H	—	—	15·00	—	—	11,300	50	—	—	—	1950	11	52·782	—	—	—
273	Quoich	H	—	—	22·00	—	1×22	12,870	320	—	—	—	1955	11	91·531	—	—	—
274	Rannoch	H	—	—	48·00	—	3×16	7,500	512	—	—	—	1931	11	149·674	—	—	—
275	St. Fillans	H	—	—	21·00	—	1×21	1,298	830	—	—	—	1957	11	24·167	—	—	—
276	†Shin	H	—	—	24·00	—	2×12	11,350	265	—	—	—	1958	11	6·417	—	—	—
277	Sloy	H	—	—	130·00	—	4×32·5	1,240	910	—	—	—	1950	11	104·372	—	—	—
278	Sron Mor	H	—	—	5·00	—	—	750	160	—	—	—	1957	11	1·498	—	—	—
279	Stornoway (new	I	—	S	7·68	—	—	—	—	—	—	—	1951	11	18·651	—	—	4·3
280	Storr Lochs	H	—	—	2·85	—	—	190	447	—	—	—	1952	3·3	5·859	—	—	—
281	Striven	H	—	—	6·00	—	—	440	403	—	—	—	1951	3·3	17·758	—	—	—
282	Tobermory	I(H)	—	—	1·20	—	—	—	140	—	—	—	—	0·415	hydro 0·517 diesel 1·465	—	—	— 0·4
283	Torr Achilty	H	—	—	15·00	—	—	12,100	52	—	—	—	1954	11	29·493	—	—	—
284	Tummel Bridge	H	—	—	34·00	—	2×17	9,400	173	—	—	—	1933	11	54·114	—	—	—

* In operation, January, 1959. † One set only 1958. Note: No figures available from N.S.H.E.B. for time generating.

GENERATING STATIONS UNDER CONSTRUCTION OR PLANNED

Map Ref.	Division	Project Group	Station	Type of Prime Mover	Planned Capacity—MW
	CENTRAL ELECTRICITY GENERATING BOARD				
285	London	Southern	Belvedere	S	480
286	South Eastern	Southern	Northfleet	S	720
287	South Western	Southern	Berkeley	NS	320
288	South Western	Southern	Hinkley Point	NS	561
289	Eastern	Southern	Little Barford 'B'	S	120
290	Eastern	Southern	Bradwell	NS	312
291	Eastern	Southern	West Thurrock	S	1,000
292	East Midlands	Midlands	Drakelow 'B'	S	480
293	East Midlands	Northern	High Marnham	S	1,000
294	East Midlands	Midlands	Staythorpe 'B'	S	360
295	East Midlands	Midlands	Willington 'B'	S	400
296	Midlands	Midlands	Rugeley	S	600
297	South Wales	Midlands	Aberthaw	S	600
298	South Wales	Midlands	Uskmouth 'B'	S	360
299	Yorkshire	Northern	Elland	S	180
300	Yorkshire	Northern	Skelton Grange 'B'	S	480
301	Yorkshire	Northern	Thorpe Marsh	S	1,100
302	North Eastern	Northern	Blyth 'B'	S	550
303	North West, Merseyside and North Wales	Northern	Padiham 'B'	S	240
304		Northern	Ffestiniog (Pumped Storage)	H	300
305		Northern	Rheidol	H	49
306		Northern	Trawsfynydd	NS	500

Map Ref.	Station	Type of Prime Mover	Capacity—MW
	SOUTH OF SCOTLAND ELECTRICITY BOARD		
307	Kincardine (Ext)	S	400
308	Hunterston	NS	360
	NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD		
309	Aigas	H	20·0
310	Ben Hee	H	5·0
311	Cashlie	H	11·0
312	Cassley	H	10·0
313	Culligran	H	24·0
314	Deanie	H	38·0
315	Doe	H	6·0
316	Garvault	H	1·0
317	Gisla	H	0·6
318	Kilmorack	H	20·0
319	Lednock	H	3·0
320	Livishie	H	9·0
321	Loch Chliostair	H	0·7
322	Luib	H	6·0
323	Mucomir	H	1·5
324	Orrin	H	18·0

IRON AND STEEL RESEARCH

THE 15th annual report of the British Iron and Steel Research Association includes descriptions of some of the work which has been carried out by the Association. A system for automatically controlling power input, developed at B.I.S.R.A.'s 10 cwt arc furnace, ensures that, if the temperature of the roof exceeds a suitable working level, the voltage is automatically reduced in stages until the desired temperature is reached. In addition, the control system comes into action during melting down, if the rate at which the roof temperature rises indicates that power is being dissipated wastefully. A programme controller has been designed and successfully tested on this furnace and arrangements are being made for connecting similar controllers to production furnaces.

Fundamental investigations into the character of the arc in the electric arc furnaces continued and two ciné films in colour have been made. Heat transfer measurements on the 10 cwt arc furnace have shown that the arcs must be short if heat is to be transferred efficiently to the liquid steel during refining. Thermal losses must be balanced against electrical losses and there appears to be an optimum low voltage for refining.

Investigation of the effects of impurities on the magnetic properties of 3 per cent silicon-iron has led to conclusions which may result in the reduction of eddy current as well as hysteresis losses in transformers. Other studies included the use of radioactive isotopes as tracers in the study of phenomena of diffusion and mixing in the slag layer in a blast furnace. The B.I.S.R.A. "Pegasus" computer has been used for further investigation of the problem of assessing blast furnace performance by statistical methods.

Financing Electricity Expansion

Government Control of Capital Investment: Emphasis on Generation

By D. J. BOLTON, M.Sc., M.I.E.E.

After briefly referring to the two methods of meeting the industry's capital investment requirements—self-financing and external loans—the author discusses the effects of Government control. Because of the long-term nature of the generation programme, in periods of financial stringency distribution has largely borne the brunt of restrictions and the implications of this are considered. On the future trend, it is shown that the pattern of capital investment will be dominated by nuclear power

AN industry which is growing at the rate which electricity supply is maintaining in this country is in constant need of fresh capital, and this is particularly so when the growth is not only in size but also in complexity. New techniques are apt to require disproportionately high investments, and the advent of nuclear generation at more than double the cost per kilowatt will intensify still further the capital requirements of the generation programme. It is true that some of these requirements can be met from within the industry by what is described as " self-financing "—i.e. by using depreciation and other reserves in lieu of external loans. In recent years the United Kingdom electricity industry (excluding the North of Scotland) has been able to supply up to 40 per cent of its capital needs in this way leaving only 60 per cent to be covered by fresh borrowing.

In the supply industry, just as in a private manufacturing industry, there are limits to the extent to which an undertaking can be self-financing in this way. These limits depend on how fast the industry is growing and how much of its capital expenditure is on long-term projects such as hydro schemes, rural electrification and nuclear generation whose costs are high in proportion to the immediate returns. Any reserves additional to those which are strictly required to cover actual depreciation can only be built up out of annual surpluses—i.e. by keeping the general level of charges somewhat above the level of costs—and beyond a certain point this begins to look like taxing present consumers for the benefit of future consumers. It must probably be assumed as a normal condition of electricity supply growth that at least half of its annual capital requirements will always have to be met by increased borrowing. In any country in which the industry is nationalised this will necessarily involve the government either in sanctioning the loan or in actually providing the money.

How Control is Exercised

Government control of capital growth in electricity supply is exercised in two ways. The generation construction programme is subject to approval on a physical basis (i.e. installed capacity) and the total programme, both generation and distribution, is controlled on a financial basis (i.e. capital expenditure). The recent White Paper " Capital Investment in the Coal, Electricity and Gas Industries " (Cmnd. 713) (see *Electrical Review*, 17th April, page 720), is the last of three devoted specifically to the power industries and published in the Aprils of 1957, 1958 and 1959. In previous years there have been Economic Surveys of a more general character issued from time to time. In all these Government papers, figures of approved capital expenditure have been given for the different sections of the industry.

In addition to the changes in magnitude of capital investment as laid down in these White Papers there have been substantial changes in the mechanism whereby finance has been provided. These changes have concerned the electricity and gas industries but not coal which has continued to draw its finance for capital purposes by way of advances from the Minister. These changes are not dealt with in the present article because although fundamental in character they do not appear to have materially affected either the extent of Ministerial control or the actual amounts of capital forthcoming.

Looking at the whole period since nationalisation, as described in the ten annual reports of the Central Authority, there appear to have been two spells of financial stringency during which investment was curtailed and capital programmes were pruned or deferred. These occurred in the years 1948 to 1950 and again in the years 1955 to 1958. Between these two spells and following the second one came periods (including the present moment) during which the financial situation became easier. Brakes were taken off and there were even occasional jabs at the accelerator. Thus, at the end of 1958, authority was given for additional expenditure to be incurred on capital works of a short-term character which could be brought forward, and an extra ten millions capital expenditure by the Electricity Boards was sanctioned for 1959.

As will be seen from a later illustration, this see-saw of alternate check and encouragement does not seem to have had a great effect on the actual capital sums spent year by year, particularly on the generation side. Nor could any lesser degree of Government control have reasonably been expected. One of the claims most generally made for nationalising a substantial sector of industry is that through its control of this sector the Government of the day can regulate the volume of capital investment, checking it when money is tight and manufacturing capacity is fully extended, and expanding it when financial conditions are easier and capacity is underemployed.

But if the frequency of alternation of the financial urge becomes too great the result is bound to look somewhat ridiculous when applied in a field like electricity genera-

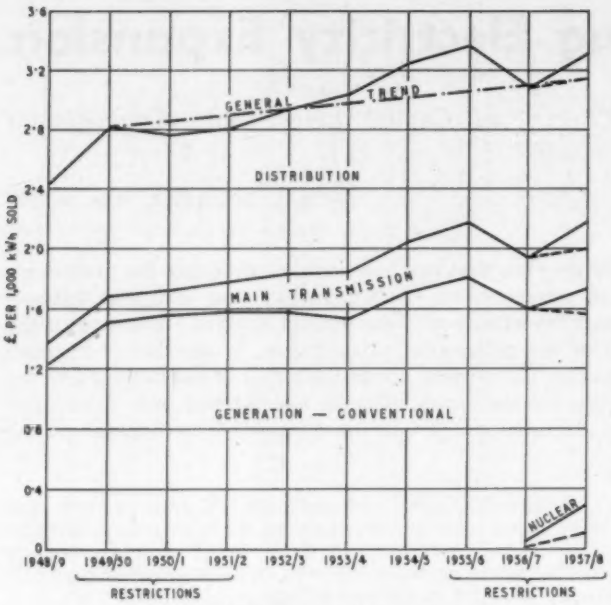


Fig. 1.—Relative annual capital expenditure

tion whose plans take five years or more to mature. If, for example, in the year x of financial stringency the industry is asked to make a cut in its capital investment the Central Authority may have to register a protest that, in consequence, the amount of generating plant coming into commission in the year $x + 3$ will be correspondingly reduced. Yet long before the year $x + 3$ is reached the financial climate may have changed completely, red lights have switched to green throughout the industrial countryside, and it then becomes desirable (but unfortunately not possible) to accelerate what was previously retarded.

One consequence of the long-term nature of the generation programme is that it is largely distribution that has to bear the brunt of the fluctuations and to act as a cushion to take the shocks for which the power station programme is insufficiently elastic. There is logic in this too, for when finance is restricted this usually means that the whole country's economy is in a non-expansive state. Developments of all kinds are held up or slowed down, including housing and hospitals, factories and shops, and the demands on the Area Boards for increased supplies and services can be expected to be somewhat lessened. This does not, however, take account of the steady relentless growth in the need for mains reinforcement and replacement, a need which is easily lost sight of but cannot be indefinitely denied.

Technical Consequences of Financial Restrictions

Even where the direct numerical effects of financial stringency on the construction programme do not appear to have been great there may be indirect effects of some consequence. When plans for what are regarded as essential developments have to be severely cut, and later on perhaps expanded again, this is bound to introduce some feeling of instability, not to say frustration. More serious is it when the character of a programme has to be changed due to temporary financial difficulties, as happened in 1958 when the nuclear programme was put back by one year and a corresponding increase made in the coal-fired plant. The decreasing proportion of investment on distribution is probably also partly attributable to the same factor.

To an engineer it seems axiomatic that decisions such as the choice between coal and oil firing, between conventional and nuclear fuels, between hydro and thermal schemes or between prime-mover and pumped-storage stations should be determined on their technical and economic merits and should not be influenced by financial and political considerations which may change completely before the plant is even built.

Annual Fluctuations in Capital Expenditure

In absolute terms the capital expenditures of all the Electricity Boards, generation and distribution alike, have gone up every single year. A graph of these expenditures would mount steadily upwards and would not be very informative regarding annual fluctuations. What is needed is an index of relative expenditure, and the question arises—relative to what? Since plant requirements are related to maximum demand this would seem to be the obvious denominator but it suffers from certain disadvantages. It is known only at the bulk supply point and not for distribution, it fluctuates with the severity of the weather, and its relation to plant investment is subject to a big time lag.

On balance it seems best to relate capital expenditure to the total output of the industry as measured by the electricity sold to consumers, and this has the advantage that no discontinuity is shown at the point where the South Scotland Boards were hived off. The graph in Fig. 1 plots the annual capital expenditure on fixed assets, in £ per 1,000 kWh sold, for the first ten years since the nationalisation of the industry. The North of Scotland is omitted entirely and the last three years' results refer to England and Wales only.

The general trend of capital expenditure per unit has been only very slightly upward (discounting the first year). The rise in the last year is clearly due to the influence of the nuclear generation programme, and in order to put the graph on a uniform technical basis it would be necessary to reduce the slope of the "nuclear" line (bottom right-hand corner) to rather less than half with a corresponding reduction in the heights of the final points on each curve. (This hypothetical reconstruction has been indicated by dotted lines.) A straight line (chain-dotted, marked "General Trend") has been drawn from the second year to the reconstructed point of the last year and may be regarded as representing the general trend under conditions where generation is entirely from conventional stations. A new and somewhat steeper trend line can be expected to start from about 1956 owing to the increasing proportion of nuclear plant with higher capital costs.

The periods of economic restriction are shown by brackets on the graph. The response to these restrictions is clearly, though not alarmingly, shown in the behaviour of these curves, particularly in the belt representing distribution expenditure. The total expenditure line dips appreciably below the trend line during the restriction periods and rises above it elsewhere.

Changing Proportions of Generation and Distribution Capital

The most striking change in the capital expenditure since nationalisation has been in the shares allotted to the Central Authority and the Area Boards respectively. In the past it has been usual to regard about two-fifths

of the total capital as being on generation, interconnection and high-voltage transmission and three-fifths on distribution. This was, in fact, the position at vesting day, but in respect of post-nationalisation expenditure the proportions have been more than reversed. As a result, the position for all plant at 1st April, 1958, was that considerably more than half lay in the Central Authority's province. The following table shows these proportions.

PROPORTIONAL EXPENDITURE ON FIXED ASSETS

	Central Authority	Area Boards
Total vesting at 1st April, 1948	40%	60%
Purchased during ten years to 1st April, 1958	63%	37%
Total book value at 1st April, 1958 { Generation 48% / Main Transmission 8% }	56%	44%

It is difficult to account entirely for this change in the proportion of investment on the two sides of the industry. It is not due to the extra cost of nuclear stations since this has not been a factor for long enough to make an appreciable difference to the total. Nor is it that generating plant has risen more than distribution plant in cost per unit of capacity. If anything the difference is probably the other way round since the employment of larger generating sets has helped to keep down the price per kilowatt of conventional stations.

Doubtless the fact already mentioned, namely, that when finance is restricted the distribution programme suffers most, has had something to do with it. Even so, one would expect that when conditions became easier the deferred distribution plans would have been proceeded

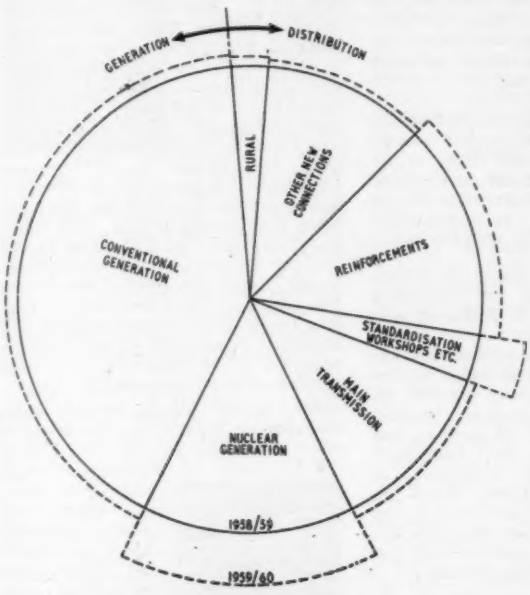


Fig. 2.—Capital expenditure allocation

with, bringing the investment back to its original proportions. Doubtless, however, some plans, such as those for standardisation of systems and voltages, will have been held over more or less indefinitely.

Whatever the explanation it would appear either that considerable economy in distribution capital equipment has taken place since nationalisation (possibly due to improved distribution technique) or else that there are formidable arrears of work needing to be carried out. A distribution programme never has quite the glamour or political appeal of a power station programme, nor has it the same urgency since the damage done by even the most serious distribution overload is not likely to endanger the whole supply. But distribution is just as vital a link in the chain as generation and if it has been (relatively) starved for capital in recent years this will have to be made up if the whole system is not to suffer.

Future Pattern of Capital Investment

The immediate future is indicated in the White Paper to which reference has already been made. Details of capital expenditure in England and Wales (excluding that on nuclear fuel) are given under various heads and these are represented by the areas of the sectors in the circle or "pie" diagram, Fig. 2. The full lines show the estimated expenditure in 1958-59 whilst the dotted arcs represent the approved programme for 1959-60. The latter use the same angles and sectors as the former so that the areas lying outside the full circle and enclosed by the dotted arcs represent the increases in the later year.

The general pattern is similar to that of previous years except that the proportion going to generation and main transmission is increased to about 68 per cent owing to the substantial expenditure on nuclear stations. The rapid build-up of this programme can be seen by comparing the full line circle with the last point on Fig. 1, one year earlier. In the programme approved for 1959-60 the expenditure on nuclear stations is already half that on conventional stations and is 60 per cent of the figure allotted for the whole of distribution.

It is quite evident that the future pattern of investment in the supply industry will be dominated by the nuclear station programme. On the speed at which nuclear building takes the place of conventional building will largely depend the amount of new capital that will be required. Atomic power may be regarded as one more step in the general process of industrial mechanisation since it represents additional capital investment for the purpose of saving future labour—in this case mining labour.

E.R.A. REPORTS

Wide Range Anemometer.—The anemometer described in report Ref. O/T21, "A Wide Range Recording Anemometer" by A. N. Rapsey, price 9s, was developed for use in an investigation of mechanical vibrations caused by the action of wind on the conductors of overhead transmission lines. These vibrations occur at wind speeds down to 1 m.p.h., and records of both the wind speed and direction were required. Although there was no interest in wind speeds above 25 m.p.h., the instrument had to be capable of withstanding the highest speeds expected on exposed sites. The instrument developed will, in fact, withstand and measure wind speeds up to 100 m.p.h. The instrument had also to produce information in a form suitable for recording on magnetic tape.

Dielectric Materials.—A review of available insulating materials was given in 1951, and the present paper, report Ref. L/T380 "A Survey of Dielectric Materials" by C. G. Garton, price 15s, mainly reviews later developments, including an account of progress in some methods of insulation testing. Since the subjects are governed by the progress in various fields, which does not proceed in any very logical way, the paper inevitably reflects something of this disorder.

Copies of these reports can be obtained, at the prices stated, from the Electrical Research Association, Thorncroft Manor, Dorking Road, Leatherhead.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

Manchester University Council has established a chair of nuclear engineering in the faculty of science, and has appointed **Mr. W. B. Hall,** deputy chief scientific officer in the Research Laboratories of the United Kingdom Atomic Energy Authority at Sellafield. He will take up his duties in Manchester on a date to be arranged.

In 1946 Professor Hall became a technical engineer on the staff of the Division of Atomic Energy, Ministry of Supply. In 1951 he transferred to the Research and Development Branch of the Atomic Energy Authority. Within a year he was promoted principal scientific officer and became responsible for engineering research in the Research and Development Branch Laboratories at Sellafield. In 1956 he became a senior principal scientific officer and was later promoted deputy chief scientific officer.

After forty years' service with the General Electric Co., Ltd., **Mr. M. R. Neville,** M.C., manager of the Publicity Organisation, is retiring at his own request on 30th June. **Mr. A. C. V. Clarkson** will take over as manager as from 1st July.

Mr. M. R. Neville

Mr. A. C. V. Clarkson

Mr. Neville joined the G.E.C. in 1919 after serving with the Royal Garrison Artillery in France where he was awarded the Military Cross. A scholar of Peterhouse, Cambridge, where he obtained an honours degree in mathematics, he was one of the first trainees to enter the company under the late Lord Hirst's scheme for the employment of ex-officers. After a preliminary period of training at the G.E.C. head office, he gained operating experience in various departments and then, in 1924, joined the London Sales Department as personal assistant to the late Mr. H. Wynne Roberts. In 1933 he became assistant sales manager to Mr. T. W. Heather, a position which he held until 1950 when he was appointed manager of the G.E.C. Publicity Organisation.

Mr. Neville has always been particularly interested in welfare and, apart from his work in connection with the G.E.C. sick fund and pension fund, he has been chairman of the Welfare Committee of the Electrical Industries Benevolent Association for several years and was elected vice-chairman of the Court in 1958. He is also a member of the B.E.A.M.A. Publicity Committee and a committee member of the Advertising Investigation Department of the Advertising Association. In addition he is a governor of his old school, the William Ellis School.

Mr. Clarkson has been with the G.E.C. since 1920 when he joined the Morgan Reeve Co., Ltd., a firm of printers that was owned by the company at that time. He was transferred to the G.E.C. Publicity Organisation in 1923 and became deputy publicity manager in 1937. He is a member of the Consumer Advisory Committee of the Advertising Association and also of the Branded Goods Sub-Committee of the Public Affairs Committee of the Advertising Association. Until last September he was a member of the Radio Industry Council's Public Relations Committee, and was vice-chairman of that committee for many years. He is president of the Solus Club this year.

Mr. Clarkson was educated at St. Patrick's Cathedral Grammar School, Dublin. He joined the Army at the age of seventeen on the outbreak of the 1914-18 war, and served in France throughout the war as a stretcher-bearer with the 15th Scottish Division.

The Express Lift Co., Ltd., Northampton, announces the following appointments:—**Mr. A. J. Brown,** who has been with the company for thirty-two years, has been appointed company secretary in succession to the late Mr. S. R. Smith. **Mr. W. H. Thatcher,** with thirty years' service, the last twenty-one as cashier, has taken charge of the company's accounts and costs department in succession to Mr. Brown. **Mr. L. B. Vaughan,** who has been with the company for thirty-two years, the last twenty-one as assistant cashier, has been appointed company cashier.

Mr. G. E. Robertson, A.M.I.E.E., A.M.Amer.I.E.E., has been appointed manager, sales and contracts, of the Meter, Relay and Instrument Division of the English Electric Co., Ltd., and **Mr. P. G. Bevis** has been appointed manager, sales and contracts, of the company's Relay Department.

Mr. Robertson joined the company in 1950 on the formation of the Relay Department and, before his new appointment, held the position of manager, meter and relay sales and contracts. During the war he served with the R.A.F., attaining the rank of flight lieutenant, and he was with the Research and Development Department of the Sperry Gyroscope Co. before joining the English Electric Co.

Mr. G. E. Robertson

Mr. P. G. Bevis

Mr. Bevis joined the Relay Sales Department of the English Electric Co. in 1951, having previously been with the Meter Department of the Southern Electricity Board.

Mr. F. Duerden, B.Sc.(Hons.), A.M.I.E.E., has been appointed manager of the Electronics Department of Bruce Peebles & Co., Ltd., in succession to **Mr. J. W. Haig Ferguson,** M.A.(Cantab.), A.M.I.Mech.E., A.M.I.E.E., A.M.I.Prod.E., who has been promoted divisional director.

A native of Blackburn, Mr. Duerden took his degree at Manchester University and started his professional career with the Research and Development Department of Marconi's Wireless Telegraph Co., Ltd. During the last war he served as a radar officer in the Royal Air Force. He joined Ferranti, Ltd., in Edinburgh in 1946 as a senior development engineer and remained there until he entered the service of Bruce Peebles & Co. in 1956 as chief electronics engineer.

Mr. C. A. Burton, former sales manager of Sciaky Electric Welding Machines, Ltd., is joining the A.R.O. Machinery Co., Ltd., on 1st June, to take over new projects and developments. Mr. Burton commenced his career with the Foster Transformer & Switchgear Co., Ltd. (now a subsidiary of Lancashire Dynamo & Crypto, Ltd.), and spent two years in the design drawing office, moving on to the Workshop Fitting Department and later to the Transformer Test Department, where he was engaged in the design, develop-

Mr. C. A. Burton

ment and construction of commercial power transformers, Quasi-Arc welding transformers, neon transformers and h.v. switchgear. In 1935 Sciaky Electric Welding Machines, Ltd., decided to start its own factory in this country at Slough and Mr. Burton joined them as chief test and research engineer. During the last war he was attached to the Directorate of Industrial Electrical Equipment as regional resistance welding adviser. He was appointed sales manager of Sciaky in 1948.

The Royal Society has been informed that **Dr. Louis Essen,** a senior principal scientific officer at the National Physical Laboratory, has been awarded the A. S. Popov Gold Medal by the Academy of Sciences of the U.S.S.R. This award is for the most distinguished scientific work in the field of radio engineering performed during the period from 1956 to 1958. The work of scientists from all countries is considered, but this is the first time the award has been made to a scientist outside the Soviet Union.

Mr. M. Carpenter, B.Sc.Tech., has been appointed overseas technical representative of the Radio Division of Siemens Edison Swan, Ltd. He will promote overseas sales of the company's cathode ray tubes, valves, semi-conductors and other components for industrial and domestic equipment, mainly in the Western European market. He will be based on the company's office at 155, Charing Cross Road, London, W.C.2. Mr. Carpenter has been with R.C.A. (Great Britain), Ltd., for five years, and he was previously at the Brimsdown engineering laboratories of the Edison Swan Electric Co., Ltd.

Mr. M. Carpenter

The Minister of Power has reappointed **Mr. J. F. Beaver,** O.B.E., J.P., Shipley, Yorks., as a part-time member of the Yorkshire Electricity Board. **Mr. J. C. M. Maclagan** will retire from the Board on 31st May on completion of his present term of office.

At the meeting of the Council of the Public Transport Association held on 21st May **Mr. T. R. Williams** retired from the chair of the Association which he has occupied since May, 1957. The new officers of the Association are **Mr. A. F. R. Carling,** who was elected chairman, and **Mr. R. E. Chisnell** and **Mr. R. J. Ellery,** who were elected vice-chairmen for the ensuing year.

Mr. J. Bent has joined Rosite, Ltd., one of the Plessey group of companies, as sales engineer. He was previously with Permali, Ltd., as new products development and applications engineer, and before joining Permali he was engaged in the design of metal-clad switchgear with the Metropolitan-Vickers Electrical Co., Ltd.

Mr. Frank Kenyon, whose article on the work of the Electricity Consultative Councils appears in this issue (p. 1006), has been chairman of the North Western Consultative Council (and *ex officio* a member of the North Western Electricity Board) since 1952; he has been a member of the Council since its inception. Mr. Kenyon has been connected with the electrical industry in various ways for fifty years. Among the concerns with whom he has served are Whipp & Bourne, Ltd., Finchley Corporation Electricity Department, Crossley Motors, A. V. Roe, Metropolitan-Vickers, and Ferranti, Ltd. For nine years he was a trade union organiser and was chairman of the Manchester and District Engineering and Shipbuilding Federation for many years.

Mr. F. Kenyon

Mr. Kenyon was a member of the Oldham Corporation Electricity Committee for nineteen years and chairman for nine years. He was Mayor of Oldham in 1953-54. For eight years he served on the Council of the former Incorporated Municipal Electrical Association.

Mr. R. F. Burbridge, B.Sc., Ph.D. (Bristol), has been appointed Lecturer in Electrical Engineering in Bristol University.

Mr. L. M. Stephenson, B.Sc.(Lond.), has been appointed lecturer in the Department of Electrical Engineering of Leeds University as from 13th July next.

Mr. D. N. Gifford, commercial manager, has been appointed a director of Birlec-Efco (Melting), Ltd.

At the **Eastern Electricity Board's** Essex Sub-Area (Millfield) Sports and Social Club's ninth annual dinner and dance held on 8th May the chairman, Mr. E. A. Cullen, announced that over £85 was to be handed to the E.I.B.A. funds. The function was attended by 214 club members and friends and amongst the people present were Mr. and Mrs. H. V. Pugh, Mr. and Mrs. H. D. B. Wood and Mr. and Mrs. R. H. M. Barkham. Messrs. C. E. Bostle and E. H. Nicholls organised the function.

At the annual dinner-dance of the Essex Sub-Area (Millfield) Sports and Social Club (Eastern Electricity Board). Left to right: Mr. C. E. Bostle, Mr. E. A. Cullen and Mr. E. H. Nicholls

Mr. J. S. Storie, A.M.I.Mar.E., has taken up the post of manager in Scotland for Lister Blackstone Marine, Ltd., and Blackstone & Co., Ltd., and will operate from the Lister group offices at Baltic Chambers, Wellington Street, Glasgow, C.2. Mr. Storie joined the Lister group of companies in 1955, operating from the company's head offices at Dursley.

Mr. H. Foster, of the British Thomson-Houston Co., Ltd., Bristol, has been appointed hon. treasurer of the Bristol Branch of the Electrical Industries Benevolent Association in succession to **Mr. A. J. Nicoll.**

The **Duke of Edinburgh** has consented to become Patron of the Instruments, Electronics and Automation Exhibition, which will be held at Olympia, London, next year.

Mr. N. D. Mathie, C.A., has been appointed assistant secretary of Johnson & Phillips, Ltd. He has joined the company from Duncan Stewart & Co., Ltd., with whom he was secretary.

Mr. R. L. Cogdale has been appointed European resident technical representative of Marconi Instruments, Ltd., and will shortly take up residence near Paris. The establishment of this post will lead to a greater co-ordination of sales activities in this area and, in particular, will reinforce the company's position in the countries forming the European Common Market. Mr. Cogdale, a senior member of the technical sales staff, joined the company in 1941. After working in various technical departments dealing with production testing, service, installation, maintenance, and development, he was

Mr. R. L. Cogdale

transferred to the Export Department in 1949. He has travelled extensively overseas on behalf of the company.

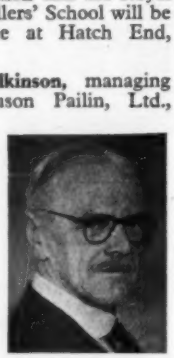
Mr. L. S. Tredgett, B.Sc.(Eng.), has been appointed assistant sales manager, Railway Signals Department of the Metropolitan-Vickers Electrical Co. After taking his degree at Queen Mary College, London, Mr. Tredgett joined the company in 1945 as a college apprentice and later went to the Switchgear Department, first as a trainee and later as an engineer in the projects and tenders section. He joined the Switchgear Sales Department in 1952, where he was section leader, e.h.v. tenders and contracts, until his present appointment.

Mr. L. S. Tredgett

Mr. R. L. Russell, D.Sc., Reader in Electrical Engineering at Bristol University since 1955, has been appointed to the Chair of Electrical Engineering at King's College, Newcastle-on-Tyne. Before going to Bristol, Dr. Russell was in the research laboratories of the British Thomson-Houston Co., Ltd.

The annual cricket match between the **Electrical Trades' Commercial Travellers' Association** and the Royal Commercial Travellers' School will be held on 6th June at Hatch End, Pinner, Middx.

Mr. J. R. Wilkinson, managing director of Ferguson Pailin, Ltd., director of the Switchgear Testing Co., Ltd., and a member of the B.E.A.M.A. Council, has been appointed deputy chairman of the Council of the Association of Short-Circuit Testing Authorities. Mr. Wilkinson has been a member of the A.S.T.A. Management Committee since the Association was incorporated in 1938, and he was appointed to the Council in 1942.



Mr. J. R. Wilkinson

The annual dinner-dance of **Switchgear & Equipment, Ltd.,** was held on Friday last week at Wincott's Café, Banbury, when about 250 members of the staff and guests with their ladies sat down to dinner under the genial chairmanship of Mr. A. G. H. Oxley (managing director). Speeches were confined to a welcome to the guests by Mr. Oxley, and a response by Mr. G. F. Peirson, deputy chairman of the Midlands Electricity Board.

Mr. Oxley, in welcoming the guests, expressed particular pleasure at the presence of Mr. J. Conrad, of Schweizer & Conrad Electric of Chicago, and Mrs. Conrad, who were visiting this country following a recent visit to America by Mr. Douglas Oxley (director). He also particularly welcomed Mr. and Mrs. Peirson, and Mr. J. D. Nicholson, chief engineer of the Yorkshire Electricity Board, and Mrs. Nicholson. He paid a tribute to the loyalty of the people who worked under him. As is customary on these occasions, a "presentation" was made to Mr. Oxley. This year it took the form of a "coat of arms" with heraldic designs appropriate to the company.

A number of the visitors made a tour of the company's Banbury works on the following morning, after which they were entertained to luncheon by Mr. Oxley.

Mr. L. Smith, B.Sc. (Eng.), A.M.I.E.E., has been appointed technical representative for North West England for the P. & B. Engineering Co., Ltd., Crawley, Sussex. After an electrical apprenticeship, R.A.F. service and a university degree course, Mr. Smith was engaged on research and development, first by the British Iron and Steel Research Association, and latterly by British Insulated Callender's Cables, Ltd., whom he joined in 1952. More recently he has been employed as regional sales engineer.

Mr. L. Smith

The annual general meeting of the **Leicester Electrical Society** was held at the Electricity Sports Club, Aylestone Road, Leicester, on 11th May when the following officers were elected for 1959-60:—President, Mr. R. March; vice-presidents, Messrs. H. E. Baxter and A. R. Ashton; hon. secretary, Mr. P. J. Mabbutt; hon. treasurer, Mr. E. E. Warrington.

OBITUARY

Mr. K. Brook, A.M.I.Mech.E., an executive director of C.A.V., Ltd., Acton, W.3, died on 16th May. He served his apprenticeship with the Keighley Gas & Oil Engine Co., later becoming chief draughtsman, and then was with Richardsons, Westgarth & Co., Ltd. He joined C.A.V., Ltd., on the technical sales staff in 1937 and in 1940 was promoted to the position of chief diesel engineer. In 1948 he joined the Gas Turbine Division of the Joseph Lucas organisation, but returned to C.A.V., Ltd., in 1953, becoming an executive director in 1955.

Mr. J. P. Yorke, O.B.E., who died recently at the age of 82, was a strong advocate of improved technical education. For twenty years he was principal of the Poplar School of Engineering and Navigation. In the 1914-18 war he served in the London Electrical Engineers and he was the inventor of the Yorke frame—an electromagnetic device for controlling the position of a searchlight arc.

Mr. R. C. Lynden, formerly chief cashier at the Trafford Park Works of Lancashire Dynamo & Crypto, Ltd., died on 20th May at the age of sixty-eight. Mr. Lynden joined L.D.C. in 1918 and retired after completing thirty-nine years' service with the company.

Mr. W. T. Gillam, of J. Stinton Jones & Partners, died on 20th May.

Sir John Dalton.—A requiem mass was held at St. Mary's Church, Chelsea, on 21st May for Sir John Dalton, whose death was reported in our last issue. The gathering at the church included Lady Dalton, Mrs. Rimmer, Sir John's daughter, and other family mourners and many representatives of all branches of the electrical industry. Interment took place at Kensal Green Cemetery.

WILLS

Sir Claude Gibb, K.B.E., D.Sc., F.R.S., chairman and managing director of C. A. Parsons & Co., Ltd., who died on 15th January last, left £294,163 gross (£250,858 net).

Mr. H. Paterson, M.I.E.E., former northern representative of the Metropolitan-Vickers Electrical Co., Ltd., who died on 2nd January last, left £7,170 gross (£6,683 net).

Sir William W. F. Shepherd, chairman of Turner & Newall, Ltd., who died on 27th February last, left estate in Great Britain valued at £47,066 gross (£16,682 net).

Mr. W. L. Turpie, founder and director of Linealux, Ltd., who died on 18th December, left £13,913 gross (£13,732 net).

Computer Film

A 40-minute 16 mm colour film entitled "Time to Think" has been produced by International Computers & Tabulators, Ltd., of 17, Park Lane, London, W.1. The film does not deal with the design and manufacture of computers but concentrates on giving the economic case for the digital computer from the point of view of the prospective user, and this is done in dramatic form by presenting the experiences of the leading personalities of a typical moderate sized manufacturing company.

The basic problem facing any organisation interested in the potentialities of a computer are dealt with, including the use which can be made of a computer, the choice of the most suitable equipment, and the necessary preparations for its installation. Computer production, research and design are briefly mentioned, and also the instruction and training of those to be responsible for its operation.

The film, which was made by Cinechrome, Ltd., is available on free loan from the Film and Lectures Department, I.C.T., Ltd., Gloucester House, 149, Park Lane, London, W.1.

E.D.A. Public Speaking Competition

The finals of the E.D.A. Public Speaking Competition were held on 13th and 14th May at the Connaught Rooms, London. On the first day twelve women from the various Area Electricity Boards took part. Miss Joyce Jones, a demonstrator in the Wrexham District of the Merseyside and North Wales Electricity Board, won the Faraday Silver Challenge Shield with a speech on "A Week in the Life of a Demonstrator." Second place went to Miss Marilyn Higgs, a demonstrator with the South Wales Electricity Board, Neath, with an address on "The History of Cooking," and Miss Helen Reeves, a demonstrator in the Sevenoaks and Reigate District of the South Eastern Electricity Board, was third; her subject was "Lighting as a Public Amenity."

There were eleven men contestants on the second day and the Yorkshire Electricity Board gained the men's shield, Mr. Malcolm Moorhouse, a counter inquiry clerk at the Halifax Service Centre, being the winner with an address on "A Place in the Sun." Second place went to Mr. Eric Richardson, an outside sales representative, Warrington Service Centre, Merseyside and North Wales Electricity Board, who spoke on "Lighting as a Public Amenity." Mr. Clifford Harris, a clerk in the engineering department of the Yeovil District of the Southern Electricity Board, was third. He chose as his subject "The History of Cooking." The judging was shared between Miss Mary George, Mrs. F. Fitzhugh, Mr. E. A. Mills, Mr. Lionel Marson, Mr. Andrew Timothy and Mr. Norman Shelley. Mr. J. I. Bernard, director and secretary of E.D.A., acted as chairman of the contests and presented the winners with their awards.

The left-hand picture shows Miss Joyce Jones (right) winner of the shield in the women's section of the E.D.A. Public Speaking Competition, with Miss Marilyn Higgs (centre) who was second, and Miss Helen Reeves (left) who gained third place. On the right are the winners of the men's section showing Mr. M. Moorhouse (right), winner of the shield, with Mr. E. Richardson (centre) who was second, and Mr. C. Harris (left) who came third

G.E.C.–M.A.N. Nuclear Agreement

THE General Electric Co., Ltd., has concluded a nuclear power agreement with Maschinenfabrik Augsburg-Nürnberg A.G. (M.A.N.), Germany. The agreement, which is initially for a period of ten years but is capable of extension, was signed on Monday at Nürnberg by Mr. Arnold Lindley (assistant managing director) and Mr. R. N. Millar (director) for the G.E.C. and by Herr Ulrich Neumann (director general) and Herr Hans Fischer (director) on behalf of M.A.N.

Mr. Lindley said that the agreement underlined the value of British experience with the graphite-moderated, gas-cooled type of reactor. Recent developments had shown that with further research that system was capable of much greater versatility than was originally envisaged.

Under the terms of the agreement M.A.N. will pay the G.E.C. a capital sum plus a service fee per kW of guaranteed electrical output from nuclear power stations ordered from M.A.N. The German company will be granted licences for all G.E.C. nuclear patents. These rights will be exclusive in the Federal Republic of Germany and non-exclusive for the rest of the world, with the exception of the British Isles and of those Far Eastern territories already covered by the previous agreement of the G.E.C. with Japan. Similarly, any inventions which M.A.N. may make relating to nuclear power plant will be available to the G.E.C. organisation.

The whole of the knowledge and experience accumulated by the G.E.C. and its collaborator, Simon-Carves, Ltd., in the design and construction of nuclear power plant will be made available to the German company. The agreement relates to all types of nuclear power plant based on the gas-cooled graphite-moderated reactor. This is particularly significant in view of the fact that the G.E.C. has completed designs for a new small reactor suitable not only for land-based operation but also for ship-propulsion applications.

The G.E.C. will also share in the knowledge and facilities of M.A.N. which has already been concerned with mechanical engineering aspects of research reactor projects in Germany. During the first stage of the agreement, the G.E.C. will normally act as main contractor for nuclear orders received. The ultimate aim, however, is that M.A.N. shall itself become competent to prepare tenders and execute complete contracts to designs resulting from the collaboration. In this G.E.C. experts will advise and assist the German organisation in setting up the necessary facilities, while M.A.N. key personnel will receive special training in the United Kingdom.

Nickel Position

World demand for nickel in 1959 is expected to be higher than in 1958, according to Dr. John F. Thompson, chairman of the International Nickel Co. of Canada, Ltd.

Speaking at the recent annual meeting of the company in Toronto, Dr. Thompson said that although nickel consumption in 1958 was considerably lower than production capacity, consumers of nickel must be assured of plentiful supplies in the years ahead if the full market potential of the metal was to be realised. Nickel production must be capable of meeting surges in demand that would arise during the anticipated upward trend in nickel consumption. International Nickel's new mining project at Thompson, Manitoba, would increase the company's annual nickel production capacity to 385 million lb.

Financial Section

STOCKS and SHARES

THE behaviour of the industrial market during the past month has shown that nobody heeds nowadays the old Stock Exchange maxim which bids the investor to sell in May and go away. On the contrary, the demand for equities has remained sufficiently insistent to keep prices moving steadily upward for most of the time. There has been some difficulty in supplying it, for so far the rise has seemed neither to tempt holders to take their profits on any large scale, nor to deter fresh buying on the part of the public, the unit trusts and the other institutions.

Market Features

Good financial results and dividend declarations have been responsible for the largest of the many price improvements recorded during the fortnight covered by the accompanying share tables. Outstanding were the rises of 11s in Ever Ready, to 39s, and of 4s 3d in British Thermostat, to 50s, in response to these companies' announcements of higher earnings in 1958, increased dividends and scrip issues to come. Bulpitts at 15s 9d and Chloride Electrical Storage at 80s also remained favourably influenced by annual results reported earlier. On the other hand, Automatic Telephone at 73s 9d, Brook Motors at 47s 6d and Bowthorpe at 15s remained on the dull side as a result of recent profits statements. Support for Decca shares, on the strength of reports of Russian interest in the company's "Navigator," has been a feature: the "A" shares rose 2s to 36s 3d. Among domestic equipment shares, Morphy-Richards moved up to 25s and Berry's Electric Magicoal to 19s 3d. The latter company's results for the year ended in March will be due in a few weeks' time. A jump of 6s 9d to 78s 9d in International Computers & Tabulators reduced the yield, on the basis of the last dividend, to 2 per cent.

Higher Prices

Under the lead of English Electric, which gained 3s 9d over the fortnight to 67s 6d, shares of the major electrical groups have shown a firmer trend. G.E.C. at 34s 6d and Reyrolle at 88s 6d were respectively 2s and 2s 9d better. In the cable group, Pyrotenax at 37s and Scottish Cables at 17s 6d moved up well, but Reliance-Clifton eased to 18s. Enfield Cable were marked up to 22s 9d in sympathy with a rise to 55s 6d in Enfield Rolling Mills. Aron Meter gained 5s to 62s 6d and among many improvements in lower-priced shares mention may be made of the gains of 6d to 1s in Pye, A. F. Bulgin, Dewhurst, Electrical Apparatus, Dubilier, and Marryat & Scott.

S. Smith Interim

The 4s shares of S. Smith & Sons (England) have risen from 13s 3d to 17s over the past month, during which the company announced an increase in the interim dividend from 3½ to 4½ per cent. The financial year ends in July, and the annual results and final dividend declaration appeared last time in November. On that occasion the

Price Changes in

Company or Board	Nom. Value	Middle price 25th May	Two Weeks' Rise or Fall	Dividend Previous	Dividend Last	Yield %	1959 Highest	1959 Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	78½		3	3	3 16 6	80½	77½
Brit. Elec. 1974/77	100	75½		3	3	3 19 6	77	74½
Brit. Elec. 1976/79	100	79		3½	3½	4 8 6	80½	77½
Brit. Elec. 1974/79	100	89		4½	4½	4 15 6	90½	87½
Overseas Electric Supply								
Calcutta Elec.	£1	19/-	−6d	6·8†	7†	12 16 0	19/6	16/-
East African Power	£1	20/-		7½	8	8 0 0	22/3	19/3
Nigerian Elec.	£1	14/6		10	10	13 16 0	15/-	13/9
Perak Hydro-Elec.	£1	14/6		12½	10	13 16 0	14/6	12/3
Electrical Shares								
Aberdare Holdings	5/-	16/9	+9d	17½	17½	5 4 6	16/9	15/6
Aerialite	1/-	8/9		51½	54	6 3 6	9/6	7/9
Allen, W. H.	£1	46/3		10	11	4 15 3	46/3	43/-
Anglo-Portuguese Tel.	£1	28/9	+6d	8	9	6 5 3	29/3	26/6
Aron Elec. Ord.	£1	62/6	+5/-	15	15	4 16 0	62/6	57/6
Assoc. Elec. Ord.	£1	62/6	+1/3	15	15	4 16 0	62/6	53/9
Automatic Tel. & El.	£1	73/9x.d.	−1/6	17	17‡	4 12 3	82/6	73/9
Babcock & Wilcox	£1	45/6	−1/9	13‡	13	5 14 0	53/9	45/6
Bakelite	10/-	26/3	−3d	15	15	5 14 3	27/6	22/-
Baldwin, H. J.	2/-	2/9	−3d	20	20	—	3/-	2/3
Berry's Electric	5/-	19/3	+2/6	10	10	2 12 0	19/3	10/9
Bowthorpe Holdings	2/-	15/-	−3d	25	27	3 12 0	15/6	11/9
British Elec. Traction: Def. Ord. "A"	5/-	39/-	+6d	25	25	3 4 0	40/-	35/6
B.I. Callender's	£1	55/9		12½	13½	4 16 9	56/6	44/9
B.I. Callender's 6% Pref.	£1	20/-		6	6	6 0 0	20/6	19/9
British Thermostat	5/-	50/-	+4/3	30	35	3 10 0	50/-	37/-
British Vac. Cleaner	5/-	7/6	−3d	10	7½*	5 0 0	7/9	4/6
Brook Motors	10/-	47/6	−2/6	25	24½*	5 2 0	54/3	46/-
Bulgin, A. F.	1/-	10/-	+1/-	45	50	5 0 0	10/-	6/9
Bulpitts	5/-	15/9	+1/6	—	15	4 15 3	15/9	10/-
Burco Dean	5/-	15/9	+1/6	22½	16*	5 1 6	15/9	12/3
Cable & Wireless: Ord.	5/-	15/-		10	10*	3 6 9	15/-	12/3
4% Loan	100	94½		4	4	4 4 9	95	93
Chloride El. Storage "A"	£1	80/-	+2/-	17½	20‡	5 0 0	80/-	65/6
Clarke Chapman	£1	52/6	−3/3	27½	13‡*	5 4 9	66/3	52/6
Cole, E. K.	5/-	20/-	+3d	17½	17½	4 7 6	21/3	17/3
Contactor Switchgear	5/-	14/6	+6d	20	14*	4 16 6	14/6	12/-
Cossor, A. C.	5/-	8/6		2½	Nil	Nil	9/-	6/3
Crabtree	10/-	30/9	−6d	20	20	6 10 0	31/6	28/-
Crompton Parkinson	5/-	14/3		16	12*	4 4 3	14/3	11/9
Davis & Timmins	5/-	15/-		18	20	6 13 3	15/3	14/6
De La Rue	10/-	35/9	+3d	35	17½*	4 18 0	35/9	30/3
Decca "A"	10/-	36/3	+2/-	43‡	50	5 10 3*	40/3	33/3
Desoutter	5/-	26/6		32½	21‡*‡	4 1 6	26/9	19/-
Dewhurst	2/-	8/-	+6d	20	20	5 0 0	8/3	7/3
Dictograph Tel.	2/-	8/3		20	20	4 17 0	8/3	7/-
Dubilier Condenser	1/-	3/-	+6d	30	20*	4 0 0	5/-	3/3
Duport	5/-	12/-		25	12½*	5 4 3	12/-	10/3
E.M.I.	10/-	53/-	−1/3	15	20*‡	3 15 6	64/6	50/-
Electrical Apparatus	5/-	14/-	+6d	12½	14½	5 3 6	14/-	13/-
Electrical Components	5/-	14/3		12½	12½	4 7 9	14/3	10/6
Elec. Construction	£1	32/-	+6d	8½	8½	5 6 3	32/-	27/9
Elliott-Automation	5/-	27/6		—	10‡	1 16 3	30/6	16/9
Enfield Cable Ord.	£1	22/9	+2/6	2½	Nil	—	22/3	16/3
English Electric	£1	67/6	+3/9	14	14	4 2 9	67/6	56/9
English Electric 3½% Pref.	£1	12/6		3½	3½	6 0 0	12/9	12/3
Ericsson Tel.	5/-	23/6		12†	13†	4 16 0	27/3	23/3
Ever Ready	5/-	39/-	+11/-	20	27½‡	3 10 6	39/-	22/-
Falk Stadelmann	£1	28/-		17½	10*‡	7 2 9	32/9	26/3

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

dividend was increased in effect from a total equivalent to 10 per cent, on present capital, to 12½ per cent, including 2½ per cent in the form of an interim payment, and the distribution was covered almost four times over by a substantially increased surplus of profits. In the current year the company expected to spend about £2·4 million on fixed assets, and to cover it almost entirely from retained profits and depreciation without any large depletion of the liquid funds. This would bring near to completion a three-year programme of capital expenditure on expanding production facilities.

Electrical Investments

Company or Board	Nom. Value	Middle price 25th May	Two Weeks' Rise or Fall	Dividend Previous	Dividend Last	Yield % £ s d	1959 Highest	1959 Lowest
Electrical Shares—continued								
G.E.C.	£1	34/6	+2/-	12½	10	5 16 0	40/3	31/3
G.E.C. 6½% Pref.	£1	20/6		6½	6½	6 6 9	21/6	20/3
General Cables	5/-	9/3		24	15	8 2 3	9/3	7/6
Greenwood & Batley	£1	84/-		17½	20	4 15 3	84/-	75/-
Hackbridge Holdings	5/-	16/3		20	20	6 3 0	16/9	14/3
Hackbridge & Hewittic	5/-	14/6		20	20	6 18 0	16/3	13/9
Head Wrightson	5/-	27/9	+1/6	17½	20	3 12 0	28/6	24/3
Heatrae	2/-	7/6	−1/6	20	20	5 6 9	10/-	7/6
Holophane	5/-	14/9	−9d	37½	22½*	7 12 6	16/6	14/9
Hoover	5/-	66/-	−6d	50	60	4 11 0	66/6	55/-
I.C.I.	£1	34/6		12	8*	4 12 9	38/3	33/-
Intl. Combustion	5/-	36/6		25	30‡	4 2 3	36/6	29/9
Intl. Computers & T.	£1	78/9	+6/9	—	8‡	2 0 9	78/9	57/6
Johnson & Phillips	£1	26/3	−1/3	10	5	3 16 3	30/6	22/-
Lancashire Dynamo	£1	56/3	−1/3	11	12½‡	4 8 9	57/6	42/-
Laurence Scott	5/-	17/9	+6d	15	15	4 4 6	17/9	16/6
Lister, R. A.	£1	40/3	+3d	10	12½	6 4 3	41/-	32/9
Lucas, J.	£1	50/-		7½	10‡	4 0 0	50/-	43/3
Marconi Marine	£1	41/-	+1/-	10	10	4 17 6	48/6	40/-
Marryat & Scott	2/-	10/-	+6d	35	37½	3 15 0*	10/-	8/6
Mather & Platt	£1	45/-		15	10‡*	4 12 0	51/6	41/3
Metal Industries	£1	47/6		9	14	5 18 0	47/6	39/9
Midland Elec. Mfg.	£1	45/-	+6d	12½	10*	4 9 0	45/-	41/6
Morphy-Richards	4/-	25/-	+1/9	20	20	3 4 0	25/-	18/-
Murex	£1	45/-	−1/6	20	17½	7 15 6	49/6	42/-
Newman Ind.	2/-	2/9		10	10	7 5 6	2/9	2/3
Oldham & Son	1/-	3/-		17½	17½	5 16 9	3/-	2/6
Parsons, C. A.	£1	46/9	+3d	7½	8½‡	3 9 9	55/9	46/-
Philips' Lamps	Fl.10	120/-		14	14	2 4 0	121/6	88/-
Plessey	10/-	91/3	+3d	30	30	3 5 9	92/-	70/6
Pye	5/-	16/-	+9d	12½	12½	3 18 3	16/9	13/9
Pyrotenax	5/-	37/-	+1/6	—	27½‡	3 14 3	38/3	33/9
Reliance Clifton	5/-	18/-	−1/3	13½	15	4 3 3	19/9	17/6
Reyrolle	£1	88/6	+2/9	17½	17½	3 19 0	98/-	85/9
Rheostatic	4/-	10/3	−6d	12½	12½	4 17 6	10/9	8/3
Richardsons Westgarth	10/-	14/6	+9d	8½	8½	5 15 0	15/3	13/9
Scottish Cables	4/-	17/6	+1/6	27½	27½	3 13 0*	17/6	13/3
Simon Carves	5/-	30/6		25	25	4 2 0	32/-	28/6
Smith (England), S.	4/-	17/-	+1/6	20	12½*‡	2 18 9	17/-	11/6
Southern Areas	£1	15/-	+1/3	7½	Nil	Nil	15/-	10/6
Strand Elec.	5/-	10/-	−3d	15	15	7 10 0	10/3	8/6
Sturtevant	5/-	20/-		15†	15†	6 10 6	20/-	17/-
Sun Elec.	£1	82/6	+2/-	25	25	6 1 3	82/6	66/-
Switchgear & Cowans	5/-	12/3		22½	15*	6 2 6	13/-	10/3
Taylor Tunnicliff	5/-	23/3	+1/6	17½	17½	3 15 3	26/-	18/-
T.C.C.	10/-	43/9		25	25	5 14 3	43/9	38/-
Telephone Mfg.	5/-	5/9		10	10	8 14 0	5/9	4/9
Telephone Rentals	5/-	15/9	+6d	12½	12½*	3 19 3	15/9	11/9
Thompson (John)	5/-	22/9	−1/9	25	25	5 10 0	25/6	22/9
Thorn Elec.	5/-	35/9	+9d	17½	17½	2 9 0	38/6	26/3
Thornycroft	£1	23/-	−2/9	12½	7½	6 10 6	25/9	20/6
Tube Investments	£1	87/6	+1/9	15	17½	4 0 0	87/6	71/6
Vactric	5/-	41/3	+3/9	25	25	3 0 6	44/6	26/3
Veritys	5/-	2/6		12½	2½	—	5/-	1/3
Walsall Conduits	4/-	20/9	−6d	20	22½	4 6 9	22/3	16/9
Ward & Goldstone	5/-	42/-	+1/-	40	25*	2 19 6	42/-	30/6
Watford	2/-	8/9		25	25*	5 14 3	9/-	7/6
Westinghouse	£1	43/9		10	10	4 11 6	47/-	39/6
West, Allen	5/-	12/3	−3d	12½	11½*	4 15 3	14/-	11/9
Wolf Electric	5/-	8/-		10	10	6 5 0	8/6	7/9

Burco Dean

Another announcement of an increased interim dividend has come from Burco Dean, who are paying 6 per cent on account of the year ending next September, or 1 per cent more than the corresponding distribution for 1957–58. That period included the effects of the credit squeeze at its hardest, but profits contracted to no more than a small extent and there was a modest increase in the dividend to a total of 16 per cent. At the annual meeting the chairman reported that the ending of the credit squeeze had produced an immediately beneficial effect upon the order book, and that plans were on hand for the construction of another factory: he expected that the group's resources would cover the cost, but did not rule out the possibility of a share issue. The 5s shares have risen to 15s 9d.

R. B. Pullin Issue

Fresh capital is being raised by R. B. Pullin to the extent of a little over £600,000 by a "rights" issue of new 2s ordinary shares at a price of 7s 3d, which is payable in full by next Tuesday, 2nd June. They have been available recently at a premium of about 5s on the issue price, and will be transferable free of stamp duty until near the end of next month. Proceeds of the issue will cover the cost of recent acquisitions and leave about £218,000 over to augment the working capital of the group as a whole. Trading in the present year was said in the company's statement to have continued satisfactorily. It is the directors' intention to pay an interim dividend of 5 per cent (not applicable to the new shares) in July and a final of 20 per cent on the increased capital. This indicates a yield of a fraction over 4 per cent on the 2s shares at an all-in price of 12s 3d.

Engineering Results

Since the announcement of the Babcock & Wilcox annual results in the early part of this month, the news from other members of the principal nuclear power construction groups has produced mixed reactions in the market. Head Wrightson fulfilled best expectations in showing increased earnings and in declaring an eighth successive increase in the dividend, from 17½ to 20 per cent. The new rate has fourfold cover from the net surplus. Richardsons Westgarth 5s shares were also firmer, at 14s 6d, after the announcement of a net profit close up to the previous year's figure and the repetition of the dividend at 8½ per cent. John Thompson report a 27 per cent contraction of group trading profits in 1958, but are maintaining the dividend at a total of 25 per cent. The 5s shares were quoted 1s 9d lower at 22s 9d.

REPORTS and DIVIDENDS

Lancashire Dynamo Holdings, Ltd.—The main figures in the accounts for 1958 were given in our issue of 24th April.

The current year marks the 60th anniversary of the foundation of the company, and in the full report and accounts, now issued, Lt.-Col. G. S. Marston (chairman) precedes his statement to stockholders with a brief survey outlining the strength of the group's background and its widely developed interests today.

In his review of the year, the chairman says that 1958 was another record year both in turnover and in profit. Dealing with the activities of the various companies in the group, Lt.-Col. Marston says that the sales of the Trafford Park factory of Lancashire Dynamo & Crypto, Ltd., established a new record. Thousands of machines were dispatched to the home and overseas markets, including a wide range of electric motors for a large new Russian tyre factory. Also delivered were the first 4,400 b.h.p. motors of their type for the Bradwell nuclear power station, and other large and special motors for the new Rugeley thermal power station. Important extensions have been made in the testing capacity of the factory which will make ample provision for the high standards of testing needed for the large and special motors now being produced for nuclear power stations and other specialised applications.

Despite keen competition, the total value of orders placed with the Willesden works during 1958 was practically the same as for the previous year. Many important development projects, including a new range of flameproof motors and permanent magnet control rod motors for nuclear power stations, were completed.

Foster Transformers, Ltd., achieved record sales and profits. Improvements in the design and methods of manufacture have enabled the company to increase its sales of standard power distribution transformers, and have strengthened its ability to meet the increasing competition now being experienced. In addition, the development of the company's many special products for electrical testing, voltage regulation and other applications were accelerated.

The total volume of orders obtained by J. G. Statter & Co., Ltd., was greater than in any previous year. Export orders amounted to 45 per cent of the total orders received. Home sales continued at a satisfactory level and as a result of the recent Electrical Engineers' Exhibition further records both as regards orders and output can be anticipated during the current year. Many important developments were completed during the year, including new designs of h.v. and l.v. switchgear which will come into full production during the course of the present year.

In the electronic field, Lancashire Dynamo Electronic Products, Ltd., achieved new records in turnover. Production plant was materially increased and many new manufacturing techniques were introduced.

Lancashire Dynamo Nevelin, Ltd., moved to Oxted during 1956 and here extensive development work was carried out during the year which helped to lessen the effect of recessional business activities during the latter part of the year. Continued progress was made in the redesign and development of new l.v. switchgear, motor control gear and centralised power control units. A number of new products were produced and successfully marketed during the year.

Crypton Equipment, Ltd., is now entering upon a period of expansion due to extensive development work carried out during the past three years. This has led to the adoption of Crypton test equipment by leading motor vehicle manufacturers and greatly increased demand from automobile service stations throughout the world.

Crypto, Ltd., which produces and markets a wide range of modern food preparing machinery, has continued to make satisfactory progress despite intensified competition, particularly in the export field.

Malcolm & Allan (London), Ltd., has had a record year. In the export field a major contract in Rhodesia has recently been completed and other export projects are now in hand for Malta, Jordan and Poland.

Dynamo & Motor Repairs, Ltd., became a fully owned subsidiary in 1957 and has achieved a record turnover and profit for 1958.

International Rectifier Co. (Great Britain), Ltd., has been formed in partnership with the International Rectifier Corporation of America for the development and manufacture of silicon semiconductors. These rectifiers will be produced in a new manufacturing plant at Oxted.

Reviewing the future, the chairman says that increased competition is now being experienced, is still likely to continue and may become even more severe. They must accept these competitive conditions as a challenge and he is confident that they are as well equipped to meet them as anyone in the industry.

Power Securities Corporation, Ltd.—The annual meeting will be held on 11th June. In his review of 1958, which has been circulated to shareholders, Sir Andrew MacTaggart (chairman and managing director) says that during the year they took an active part, in association with important Canadian, British and other interests, in the formation of the Peace River Power Development Co., Ltd., a company incorporated in British Columbia for the purpose of making investigations into the power potentialities of the Peace River in that Province. They have subscribed for part of the share capital of the company, and have been appointed its London managers, general co-ordinators and advisers. In addition, a further new company has been formed in British Columbia jointly by Balfour, Beatty and the British Columbia Engineering Co., named B.C. & B.B. Power Consultants, Ltd. This company has been appointed consultants to the Peace River Power Development Co. Certain members of the Power Securities Corporation technical staff have been seconded to B.C. & B.B. Power Consultants and design work is making good progress.

Their principal engineering and construction company, Balfour, Beatty & Co., Ltd., celebrates its jubilee this year. Construction of the Staythorpe "B" power station has proceeded satisfactorily during the year. At the Berkeley nuclear power station, where they are associated with the A.E.I.-John Thompson Nuclear Energy Co., the bulk of their work is ahead of programme, and is nearing completion.

Transmission line work has continued and during the year under review they completed some 414 miles of h.v. lines and 95 miles of l.v. lines. They have in hand for the C.E.G.B., the North of Scotland Hydro-Electric Board, the South of Scotland Electricity Board, and the East Midlands Electricity Board, about 830 miles of h.v. lines and 100 miles of l.v. lines.

The chairman refers to the various works being carried out by the Corporation in Iraq, Malaya, Kenya, Tanganyika and Spain, and also to the activities of the various companies in the group.

T. Clarke & Co., Ltd.—The preliminary figures for 1958 were given in our issue of 8th May. The report and accounts now issued show a trading profit of £118,193, as compared with £104,802 for 1957, to which is added £61, profit on sales of fixed assets. After meeting all charges, including £45,000 for taxation, there is a net balance of £42,116 (against £33,426). As we reported, the final dividend is 8 per cent, making 16 per cent for the year (unchanged). The balance carried forward is £86,160 (against £58,294 brought in).

In his circulated statement, Mr. A. J. Shrosbery (chairman and managing director) says that the general effect of the recession of business was offset by the increased volume of work carried out by the company during the year. This trend, however, is likely to continue with the increased competition for business, coupled with the wide fluctuations in the prices of materials and continued rises in wages and other overhead expenses. The business of the subsidiary, T. Clarke (Wales), Ltd., is being steadily

developed and has again shown a reasonable profit for the year.

The company's activities are being well maintained both in the United Kingdom and abroad and embrace all types of electrical construction work. It carried out the electrical works at Windscale atomic plant, Cumberland, and is actively engaged on electrical works for Government Departments, municipalities, commercial undertakings, hotels, hospitals, etc.

At an extraordinary meeting to follow the annual meeting on 9th June resolutions will be submitted for the capitalisation of £50,000 (£12,090 from share premium account and £37,910 from reserve) and the issue of 500,000 ordinary shares of 2s each (credited as fully paid) to shareholders in proportion of one new share for every three held. The new shares will not participate in the final dividend to be paid for 1958, but will rank for all future dividends. The issue does not imply an increase in the total amount to be distributed by way of dividend.

Blaw Knox, Ltd.—The annual meeting was held on 20th May, Mr. J. M. Wallace (chairman) presiding. In his review of 1958, which had been previously circulated, the chairman said that the exceptionally good trading year of the transmission tower section was due to the ready availability of rolled steel sections which enabled a number of outstanding and retarded contracts to be speedily delivered. Turnover in the current year would be at a much lower level due to the resumption of the normal tempo of deliveries. The value of unfulfilled orders was satisfactory and the company remained the predominant supplier in the home market. Strenuous efforts were being made to strengthen the export position; there was a growing tendency towards local manufacture and here the company was in a strong position because of existing arrangements.

Matthew Hall & Co., Ltd.—The annual meeting was held on 19th May, Mr. B. Baden presiding. In his statement, which had been previously circulated, the chairman said that the order book was substantial although it did not reach the record levels achieved during the past two years. Orders included a contract for the installation of the 7,000 ton electromagnet for the 7 GeV proton synchrotron at the Rutherford High Energy Laboratory, Harwell. Work on a land-based prototype nuclear submarine involved special welding techniques to Lloyd's Class 1 requirements. Among air-conditioning contracts were those for nuclear power stations and a large plant for the proton synchrotron at Harwell.

Richardsons, Westgarth & Co., Ltd.—Subject to audit, the group profit for the year ended 31st March last is £1,075,600, as compared with £1,470,200 for the preceding year. This figure is struck after providing £404,700 for depreciation and £399,766 for atomic and development expenditure. Taxation, including tax deferred by initial allowances, requires £465,000, leaving a net balance of £610,600 (against £659,200). Unrequired tax of £50,000 is credited to general reserve. It is proposed to pay a final dividend of 5 per cent, making 8½ per cent for the year. For 1957-58 the total distribution was 11½ per cent, but the interim dividend for that year was paid on smaller capital.

Lightfoot Refrigeration, Ltd., reports that after providing £70,954 for taxation, the group net profit for 1958 is £76,341, as compared with £55,510 for 1957. It is proposed to pay final dividends of 7 per cent on both the preference and ordinary shares, making 10 per cent (against 8 per cent) for the year.

Richard Johnson & Nephew, Ltd.—The group net profit for the year ended 28th March last, after providing £811,560 for taxation, amounts to £885,798, as compared with £907,388 for 1957-58. General reserve receives £643,255, and a special profit-sharing bonus to employees absorbs £35,000. It is proposed to pay a final dividend of 6½ per cent (against 4½ per cent), making 9 per cent (7 per cent) for the year.

John Thompson, Ltd.—The consolidated trading profits for 1958 amounted to £1,742,336, as compared with £2,411,055 for 1957, and after providing £736,868 for taxation, the net balance is £501,055 (against £783,851). The proposed final dividend is 15 per cent on increased capital, maintaining the distribution for the year at 25 per cent.

Bullers - Taylor Tunnicliff Amalgamation.—Particulars were announced last week of the proposed arrangements for the amalgamation of Bullers, Ltd., and Taylor Tunnicliff (Electrical Industries), Ltd. Taylor Tunnicliff (Electrical Industries), Ltd., is to be wound up and superseded by a new holding company, Allied Insulators, Ltd., which will acquire the issued share capitals of Bullers and the three operating companies in the Taylor Tunnicliff group, Taylor Tunnicliff & Co., Ltd., Taylor Tunnicliff (Refractories), Ltd., and Electric & Ordnance Accessories, Ltd. It is the intention that Bullers and the companies of the Taylor Tunnicliff group will, for the time being, retain their separate identities, subject to the overall direction of the board of Allied Insulators.

Preference holders of T.T.E.I. will receive twelve 6 per cent cumulative preference shares of £1 in Allied Insulators for every 11 shares held, and ordinary holders one 5s ordinary share in Allied Insulators and 5s 10d cash for every ordinary share held.

Helbert Wagg & Co., on behalf of Allied Insulators, is offering to acquire the preference capital of Bullers on a one-for-one basis, and the ordinary stock at the rate of 120 5s ordinary shares and 13 £1 preference shares in Allied Insulators for every 50 10s units held. Helbert Wagg & Co. will purchase at not less than 17s per share any preference shares in Allied Insulators which ordinary holders wish to sell. An interim ordinary dividend of 7½ per cent has already been declared by Bullers, and if the amalgamation becomes effective present holders will receive no further dividends on their existing holdings.

The following directors of Bullers and T.T.E.I. have been appointed to the board of Allied Insulators: Messrs. P. Cooper (chairman), G. H. Harris (vice-chairman), F. W. Chambers, J. V. Cooper, J. E. Harris, L. H. Jones, J. F. Moxon, T. G. D. Scrivener and J. Turner.

Associated Electrical Industries, Ltd., has announced a first interim dividend of 2½ per cent (unchanged) on increased capital.

New Companies

Nuclear Equipment, Ltd.—Registered 11th May. Capital £100,000. Designers, inventors and manufacturers of and dealers in machinery, plant, tools, equipment, devices and all other things used in the nuclear industry, etc. Solicitors: Stephenson Harwood & Tatham, Saddlers Hall, Gutter Lane, E.C.2.

Systems Engineering Services, Ltd.—Registered 12th May. Capital £100. Electronic and automation engineers, etc. Directors: R. L. Howard and Lucy S. Kentfield. Regd. office: 711, Fulham Road, S.W.6.

Liquidations

Northern Electrical Servicing Co. (Darlington), Ltd., electrical dealers and contractors, 5, Duke Street, Darlington.—Winding up voluntarily. Liquidator, Mr. A. Hopper, 6, Victoria Road, Darlington, appointed 7th May.

President Electrical Appliances, Ltd.—Particulars of claims by 18th June to the joint liquidator, Mr. H. C. Hedges, Messrs. Poppleton & Appleby, 4, Charterhouse Square, London, E.C.1.

Bankruptcies

D. R. Kemp, formerly carrying on business at 15, Farnsworth Avenue, Ashton-under-Lyne, and at North Mill, Katherine Street, Ashton-under-Lyne, under the style of Batty & Jackson, electrical contractors.—Public examination 22nd June at the Town Hall, Ashton-under-Lyne.

P. R. Gliddon and **M. E. Gliddon,** trading as Star Products, domestic electrical specialists, lately carrying on business at 59, Highland Road, Southsea, Portsmouth.—Public examination 8th July at the County Court, Ashburton Road, Kent Road, Portsmouth.

K. R. Clover, trading as K. R. Clover & Co., at 3, Market Cross, Sturminster Newton, Dorset, radio and electrical engineer.—Trustee, Mr. J. E. Ellis, 50, The Terrace, Torquay, released 24th April.

J. S. Hibbert, residing at 47, Parliament Street, Morecambe, formerly residing at 64, Knott Lane, Bardsley, Ashton-under-Lyne, and carrying on business at 39, Ashton Road, Oldham, Lancs., electrician.—First and final dividend of 1s 2½d in the £, payable at the Official Receiver's office, 20, Byrom Street, Manchester.

A. R. Hunt, trading as Hunt Brothers at 68, Thornaby Road, Thornaby-on-Tees, radio and electrical engineer.—Trustee, Mr. R. B. Howard, 4, Bridge Road, Stockton-on-Tees, released 13th May.

D. Gillon, 52, Raynel Drive, Adel, Leeds, plumber and electrician.—Supplemental dividend of 7½d in the £, payable at the Official Receiver's office, Pearl Chambers, East Parade, Leeds, 1.

Electricity Consultative Councils

What They Are and What They Are Doing

By FRANK KENYON, J.P.

The activities of the Consultative Councils are not so widely known as they should be, even in the electrical industry itself. This article, which has been written by the Chairman of the North Western Electricity Consultative Council, will help to put the Councils "on the map"

DURING recent years many opposing views have been expressed as to whether the customer receives adequate protection against inferior products or services. Some schools of thought feel that the well-known branded name, as popularised in advertising, is a sufficient safeguard. On the other hand, there appear from time to time new products which by heavy advertising can make quick impact on the public. In view of this many feel that additional protective measures are desirable.

Recently the British Standards Institution applied their "Kite mark" scheme to electrical appliances as a guarantee that an appliance was satisfactory. The mark has already been applied to electric blankets, and it is hoped that it will be extended to other electrical appliances. Standard specifications for most types of domestic electrical appliances have been issued by the B.S.I. and are followed by many manufacturers. In addition, in the domestic electrical equipment field we have institutes which test appliances and issue reports. The electrical industry has not been slow to recognise the importance of tests which can prove helpful to both manufacturer and distributor. In this connection, the Electrical Development Association, through its Testing House, and the Electricity Boards' testing departments, have done much to put forward constructive suggestions to manufacturers and to weed out products from questionable sources.

As with appliances so with the services. When the electricity supply industry was being nationalised, it was felt that, although the part-time members of Area Boards were representative of various industries and walks of life, additional bodies were necessary to represent the consumers of electricity in each Area—bodies who would work constructively with the Boards in their policy making and operations.

Constitution of Councils

Thus Consultative Councils were set up. In this, electricity joined other industries in a unique experiment introduced by the Government to ensure democratic protection for the consumer being served by public enterprise. I use the word "protection" though it is almost impossible to describe in one word the function of a Consultative Council. Early in the life of the North Western Electricity Consultative Council an enterprising journalist used the word "watch-dog" to describe it and this colourful term is perhaps ideal. Consultative Councils are very alert on the consumers' behalf. When there is something to bark about they bark fiercely and loudly.

It is perhaps a good thing to recall the make-up of Consultative Councils. There are twelve Electricity Board Areas in England and Wales and each Area is served by a Consultative Council. The members are appointed by the Minister of Power to the maximum of 31, including the chairman. It is laid down that not less than two-fifths or more than three-fifths of the members shall be appointed from representatives of local authorities, and these members are chosen by the Minister from lists of nominations submitted to him by the County Councils' Association, the Association of Municipal Corporations, the Urban District Councils' Association and the Rural District Councils' Association. The remaining members are chosen from lists submitted by bodies representing agriculture, commerce, industry, labour, and women's organisations. Provision is also made for members to be appointed to represent "the general interest of consumers."

The only paid member of a Council is its chairman. He is an ex-officio member of the Board in whose Area his Council operates and it is his job to act as a link between the Council and the Board. It is important to remember that the chairman is first appointed as such and becomes a member of the Area Board because he is chairman of the Council. Many people have got the wrong idea that the reverse is the case.

Policy and Planning

It is important to note that the Councils are not merely bodies for the collection and correction of consumers' complaints about service or quality, although this work occupies a major portion of their time. It is in the power of the Councils to participate in the formulation of policy and planning that distinguishes them from certain other "Consumers' Councils" such as those established for the nationalised coal industry. It is thus a fairly common procedure for an Area Board, before introducing some new consumer service scheme or terminating some old-established practice, to ask the Consultative Council for its views and comments. Almost invariably such consultation results in agreement, and where this has not been found possible the Board has at least had the benefit of opinions which reflect the consumers' probable reactions.

I think that anyone familiar with the workings of the Consultative Councils throughout the last ten years will agree that there would have been a far less satisfactory understanding between the industry and the public had the Councils not been brought into being. This is not surprising if one casts one's mind back to the circumstances in which the Boards were set up. They inherited two major problems which were in some directions construed to be an immediate outcome of nationalisation, whereas in reality this was not the case. The first problem was the shortage of generating plant following the all-out national effort in production of war weapons. The second concerned electricity prices, which to a con-

siderable degree had been "frozen" during the war years at Government request. When nationalisation was mooted it was hardly surprising that the existing undertakers were not inclined to fall over themselves in putting up their prices if they were going to part with their undertakings.

Another factor that resulted in nationalisation coming into being in an unfavourable climate was that many people who, in theory, believed that the industry should be publicly owned, were not necessarily happy to see large undertakings cut off from municipal corporations although they did realise that the supply industry needed integration.

In these difficult conditions the Electricity Consultative Councils began to operate in 1948. Naturally, in the early stages they were preoccupied by the individual problems thrown up by consumers who felt they were being hard done by. The question of tariffs was well to the fore. The Boards' inherited undertakings were generally running at a loss because they had postponed putting up the price of electricity and this meant that one of the unpalatable duties of the Boards was to increase tariffs. In the North West increases fell mostly on industrial centres where prices had been very low in the past, though this, of course, was compensated for to some degree by the lowering of prices in the rural areas.

Load shedding brought with it demands to spare some localities cuts in excess of a reasonable proportion. In another direction consumers were very quickly asking why it should be that in one part of the area a farmer could get supply quickly, while in another part there was a long wait. Similarly, it was asked if it were possible to hire-purchase an appliance in one part of the area on certain terms, why not in another on similar terms. The Board moved quickly to remove the more glaring anomalies and the Consultative Council co-operated very closely in helping towards this end.

These were but a few of the wide variety of questions which have been dealt with by my Council over the last ten years. Other matters have included:—Joint meter reading and collection of accounts; tariff changes and standardisation; rural electrification; safety; purchase tax; electric heating; methods of accounts collection; re-sale of metered electricity; standby supplies for industrial premises; and hire-purchase and simple hire schemes. Although it is impossible in an article such as this to adequately cover these subjects, comments on some of them may be of interest.

Electricity Charges

In the case of joint meter reading, my Council felt, after lengthy consideration, that it could not be advocated and in this we anticipated the recent findings of the Weir Committee. So far as tariff changes are concerned, in the North West the Board has adopted the practice of forwarding proposals for changes to the Council a few months before the date of implementation, thus giving the Council and its various committees an opportunity of considering the effects of the proposals and also time to obtain relevant information. In some cases counter-proposals and suggestions have been submitted to the Board and there are instances where original proposals have been modified after consultation with the Council.

Several times during the past few years Consultative Councils have advocated the abolition or reduction of purchase tax on certain electrical appliances, particularly space heaters, water heaters and refrigerators. It has been the North Western Council's opinion that with the introduction of the Clean Air Act the continued imposition of tax was contrary to the Government's policy of smoke abatement. It also considered that refrigerators were no longer a luxury when food preservation was so important. Though protests were in vain, in June, 1958, my Council again drew attention of the Chancellor of the Exchequer to the anomalous position whereby oil heaters were free of tax and electric heaters were subject to 60 per cent tax, thus encouraging the use of imported fuel as against home-generated electricity, which in the national interests seemed a bad policy. This appeal coincided with the Government's reappraisal of this particular question and shortly afterwards reductions in tax on certain electrical appliances were announced and oil, gas and electric heating appliances were placed on the same footing.

Load Factor Improvement

My Council and its District Committees have always taken an active interest in ways and means of developing off-peak load and in new and improved methods of using electricity to the best advantage. They have fully supported the North Western Board's attempts to increase its overall load factor. In this connection, electric space heating is being cultivated and it has been felt that electric floor warming should be encouraged for heating new buildings such as schools, churches, colleges, houses, etc., though it is admitted that this type of heating may not be ideal in every case. Members of the Council have helped by using their influence with local authorities and similar bodies to foster opportunities. It was in response to a suggestion by the Council that the Board held a successful series of conferences for architects, civil engineers, municipal engineers, builders and electrical contractors on methods of heating by electricity.

The North Western Council have always regarded it as one of their duties to encourage greater electrical safety and better standards in electrical appliances. They have often drawn attention to the dangers of unqualified persons interfering with installations. Some years ago, after discussions with the Board, the Council took up the matter of inadequately guarded radiators with the Home Office and Members of Parliament, and were naturally pleased when the Heating Appliances (Fireguards) Act became law in 1952. In 1956 the Council considered the question of the sale of unsafe secondhand electrical appliances and of the retailing of "shoddy" appliances by certain stores. In the latter case the problem proved difficult and has been referred to other bodies for assistance. As regards secondhand appliances, the North Western Electricity Board co-operated admirably by placing posters in all their Service Centres warning the public not to purchase any of these appliances unless they had been fully tested by electrical contractors or by the Board. A number of the posters were sent to the Electrical Contractors' Association who arranged for their distribution to members in the area.

In 1958 the question of length of flex on electrical appliances was discussed at some length by the Council, it being considered that where flex was inadequate there could be danger if an amateur electrician added extra lengths by undesirable taped joints.

A suggestion put forward by the North Western Consultative Council to the Electricity Board six years ago was the 2s 6d easy payment stamp scheme whereby consumers are able to purchase special stamps from the Board's Service Centres and certain sub-post offices for the payment of electricity and appliance accounts. The scheme has proved highly successful and the 20 millionth stamp was sold during the first few days of May. Each month shows a continued increase in the number of stamps sold, and they now average 500,000 per month.

One major question which is occupying the thoughts

of Consultative Councils is a domestic one: how to make the public realise what the Councils do and how they do it. There still seems to be a great deal of public ignorance on this question and sometimes it is suggested that this lack of knowledge is the fault of the Councils themselves. It must be remembered, however, that Consultative Councils have no large publicity resources and have to rely to a considerable extent on reports that appear in the Press following monthly meetings, and from the personal commendation resulting from consumers telling their friends of the help they have received from the Council. There must be many thousands of people in the North West who have either received guidance or reassurance, or positive help, where there has been a misunderstanding between the Board and the public.

The North Western Consultative Council meets monthly in some centre in the area, not necessarily confined to Manchester, its main city. Wherever the meeting is held the local Press is invited to attend, and as this area is one of the most important Press centres in the country considerable space has been devoted to the Council's doings during the last ten years. Occasionally deputations are received and representatives of rural councils and other bodies have appeared before the Council and stated their case. The Council is also in touch with local Members of Parliament who may feel that the local constituents are not getting the full service they need.

District Committees

Not only does the Council itself meet monthly, but meetings of District Committees covering the area are held regularly. The Press are not present at these meetings because the purpose of the meetings is to untangle problems that are brought back to the main Council. The chairman of a District Committee, however, is at liberty to issue a statement to the Press if he thinks fit.

In an endeavour to publicise my Council a certain amount of Press advertising has been done on the theme " Have you any electrical problems ? " Many thousands of leaflets have been distributed to local authorities and various organisations, and addresses have been given by the chairman or secretary of the Council and its members to various bodies. Articles on the work of the Council have also been written for the Press.

It is not generally realised that there are about 100 unpaid consumers' representatives in each Council area playing their part in the Consultative Council's work. Great pains are taken by the Minister to ensure that the people selected for the Council are those who can best serve the consumers in a particular locality or industry, but it is noteworthy that members of the Council, when gathered together, are painstaking in considering the interests of the whole of the consumers rather than the particular interest they represent.

Critics of Consultative Councils are apt to say that Councils do not make serious contributions to Board policies and in some quarters there has been a tendency to take the view that Councils are " watch-dogs which have had their teeth drawn." I am quite certain that if these critics were fully aware of the discussions which take place behind the scenes and the actions which result they would not write in these terms. I am quite sure that the members of the North Western Board would clearly agree that they would hesitate to reach any conclusion affecting tariffs or standards of service to the consumer without asking themselves how the Consultative Council would react to their proposals. The very fact that their deliberations are conditioned by such considerations must in itself prove that the Council justifies its existence. Many misinformed people have criticised the Councils for not doing what they were never intended to do. A Consultative Council is not a full-time investigating committee looking for victims to be arraigned before it. It is rather a body of ordinary consumers doing what it can to ensure that the public organisations set up by Acts of Parliament remain human in their dealings with the public. The North Western Council, while inquiring into such things as administration costs, the use of transport, outside meters, methods of payment, etc., have also tried to help the individual consumer to feel that he can still secure justice from the Electricity Board. It must be stressed that the Council do not believe that the consumer is always right; some consumers ask for special treatment which, in the final analysis, would be at the expense of the other consumers.

If you take this more modest and more realistic view of Electricity Consultative Councils, then they can claim to have done a reasonably good job. They are not complacent about this and they do not consider that everything is ideal. However, it is interesting to note that the Herbert Committee in their findings, published in 1956, stated that in their opinion Consultative Councils were doing worthwhile and creditable work in the interests of electricity consumers.

In conclusion, I would say that, although much remains to be done, the Electricity Consultative Councils have no need to be ashamed of their work so far. As the existence of the Councils becomes better known—and they publicise their work as well as they can, with very limited funds—I believe that they will go on gaining public confidence and be able to make their voices heard even more effectively. Without public confidence and without public support they can do very little, but I consider that their work justifies that confidence and support. And I believe, too, that they can serve the public in electricity matters even better in the future than they have done in the past.

Training Electricity Supply Commercial Engineers

IT was recently agreed that a graduate training scheme for commercial engineers should be recommended to the Area Electricity Boards for adoption. The scheme was the work of an *ad hoc* committee, set up last year on the recommendation of a conference with Area Board chairmen to examine the possibility of developing a training scheme with a commercial basis for engineering graduates, which would meet the requirements of the Area Boards' Commercial Departments and the Institution of Electrical Engineers. The Institution agreed that the training scheme met its requirements.

The scheme is flexible and provides for varying periods of time to be spent in basic mechanical and electrical workshops, distribution development, utilisation, consumers' departments and power station operation. The longest period of training, 9-12 months, will be in utilisation. It will cover contracting and installation work on industrial and commercial projects, including process heating, rotating machinery, mechanical handling equipment, heating installations, refrigeration and air conditioning, public lighting, and commercial catering.

Training in this section will also include the design, tendering and supervision of contracts, installation inspection, organisation and technical problems of equipment repair workshops, and display of appliances. Half the time will be spent with manufacturers of electrical appliances and apparatus of industrial and commercial rather than domestic type, or with firms providing good examples of the use of electric power in production methods.

INDUSTRY AND THE HOUSE

Finance Bill and Fuel Policy Debates

By A. M. F. PALMER, A.M.I.E.E., M.Inst.F., M.P.

ONCE again spring days and lighter nights have reached Westminster and with them the long drawn out sittings of the House in committee on the various clauses of the Finance Bill. This business causes much parliamentary congestion since it is always taken " on the floor " and nothing much else can be done until it is finished. Suggestions are being made for procedural changes in the working of the House of Commons and among them is a proposal that a special standing committee should absorb the detailed Finance Bill work.

An objection to this change, of course, is that although on Finance Bills often only a few specialists on either side participate in the main, nevertheless by full House discussion an opportunity is given to any Members who may have a constituency interest, affecting perhaps a factory or other industrial undertaking in their area, to intervene and suggest, for instance, an alteration in a purchase tax rate. Once the Finance Bill is sent upstairs to a standing committee then only those who happen to be members of the committee will be able to bring forward direct ideas for amendment.

However, this year little in any case can be done by honourable Members about changes in purchase tax rates; these, I know, still greatly interest the electrical industry. The Chancellor of the Exchequer has arranged his Budget and Bill in such a way that we are not free to move amendments to reduce or abolish any group rates.

Mr. Harold Wilson, for the Opposition, complained strongly about this restriction on the second day of the committee stage discussions. He pointed out that it had been the position until now with Finance Bills, at any rate since 1949, that Members were free to move purchase tax amendments. He asked that the Chancellor should see whether within the rules of order he could open the debate more widely by introducing a new financial resolution " on recommittal before report."

Mr. Heathcoat Amory, in reply, said it had never been his intention to suppress reasonable discussion but he thought the House should consider matters this year on the basis already agreed and then perhaps another year things could be looked at differently. Unfortunately, the Chancellor went on to create an impression—in the minds of Opposition members certainly—that the tightness of this year's procedure was largely due to inadvertence in drawing up the Budget resolutions but the Government were also rather glad of the mistake since it prevented time being taken up by inconvenient argument. The Opposition felt sore enough about the situation to divide the House in protest.

Classification of Dry Docks

Surveying the three days so far given to the Finance Bill I can say that most of the discussion has been on the change in the beer duty, on assistance for gramophone records and on allowances to married people with families; each extremely important in its own field but not perhaps of direct interest to industry. However, Dame Irene Ward, who sits for a shipping constituency, did her best. She moved an amendment to transfer dry docks for the purpose of investment and initial allowances from the category of industrial buildings to the category of plant and machinery. This would be a decided financial advantage to shipbuilders and repairers. Others in support argued that the taxation treatment of those who owned dry docks and repaired ships in other countries was on a much more generous scale than in Britain.

Resisting the amendment, the Chancellor of the Exchequer said the shipbuilding industry had already received favourable treatment. A dry dock could not be considered in isolation; it was usually one of many assets belonging to a shipbuilding company. The amendment was accordingly rejected by 199 votes to 158, a smaller Government majority than usual.

Coal and Oil

There has been a recent debate in the House on fuel and power policy, although in fact it centred narrowly around the difficulties of the N.C.B. and the mining industry. The miner M.P.s who sit for coal constituencies are naturally concerned that there should now be large surplus stocks of coal when for years their people were urged to work all out and produce at any cost. They feel also that coal, in the matter of competition with oil, is not receiving a square deal from the Government. Demands are being made that open-cast working should be ended and reliance placed on deep-mined coal.

For myself I think all this fair enough but I don't believe it should be confused with a fuel and power policy which is a horse of a rather different colour. Such a policy, if fully worked out, might not necessarily give coal the special position which, on short-term social and economic grounds, it probably deserves. My impression of the speeches in the debate was that the advocates of " coal for ever " did not necessarily help rational thought on energy policy but at the same time the studied aloofness of the Ministry—under its present direction—towards its fuel and power responsibilities is mistaken. It is a little hard to see just what useful function the Ministry of Power performs at all if the nationalised corporations and the oil industry are to be left free to go their own several ways without guidance or leadership in present circumstances. Few of us want planned direction but I believe an immediate useful step might be for the Coal Board to be given commercial freedom, which it still lacks, in the matter of price arrangements and also that the Board should offer its products at lower prices to the secondary fuel industries, electricity and gas, so that they in turn can compete more successfully than recently with imported oil.

The Nuclear Installations (Licensing and Insurance) Bill has now completed the committee stage, and quite a number of Opposition amendments have been accepted in principle by the Government. I think the discussions have been valuable in helping to disperse still further the atmosphere of fear and mystery which has clung for too long to nuclear processes. The more the whole business enters into the daily life of industry the better. When it is an Act the Bill will give the practical safeguards necessary to make this transition to normality possible.

Transistor Convention and Exhibition

Opening Ceremony Performed by Lord Hailsham

THE International Convention on Transistors, organised by the Institution of Electrical Engineers, was opened on 21st May by Viscount Hailsham, Lord President of the Council. He was introduced by Mr. S. E. Goodall, the President of the Institution of Electrical Engineers, who welcomed the guests, including 400 visitors from 26 countries.

The transistor was, said Lord Hailsham, the most significant development in electronics since the invention of the thermionic valve. The three distinguished American scientists and Nobel prize winners who discovered the transistor effect were to deliver lectures. It was a good thing, he said, for the 26 countries who were represented at the convention to be able to exchange technical information. He hoped they would carry back with them something of the hopes of a friendly future for humanity that this technical co-operation would engender. At this stage in the development of the transistor, progress could be stimulated best by a cross-fertilisation of ideas between research teams working in different organisations and in different countries.

Lord Hailsham, who opened the exhibition and convention, giving his opening address

He then expressed the thanks, on behalf of all the delegates, to the Institution of Electrical Engineers for their imagination and enterprise in conceiving and organising this convention. The main function of the convention was not the formal presentation of the papers but the opportunity of exchanging ideas through discussion of the papers. This was the purpose of printing as many as possible of the papers in advance. The papers and the discussions would be published together by the Institution at a later date. Side by side with the convention was the exhibition and, he said, we were proud of the work which Britain was doing in the scientific field and particularly in connection with transistors. He then declared both the convention and the exhibition open.

Professor Bardeen (left) and Dr. Shockley at the opening of the convention

Mr. Goodall, after proposing a vote of thanks to Lord Hailsham, introduced the three Nobel prize winners. Dr. W. H. Brattain, of the Bell Telephone Laboratories, New Jersey, traced the history of transistors, commencing when Faraday noted the negative temperature coefficient of silver sulphide in 1833. The discovery of the Hall effect in the latter part of the 19th century was the next major step until physicists began to realise that the science of rectification, photo e.m.f., thermal e.m.f. and Hall effect were all related. The advent of quantum mechanics gave the basis for the understanding of the positive charge carrier. It was while trying to produce amplification without the use of an electrolyte to overcome the surface space charge, that an emitter was used and the transistor was discovered.

Semiconductor Research

A brief review of the research in the past ten years on semiconductors was given by Professor J. Bardeen of the University of Illinois. It was only in recent years that accurate quantitative correlation between theory and experiments had been obtained. Research had not only led to an increased knowledge of conduction in semiconductors but had aided the understanding of the basic processes in such related fields as photo-conductivity, luminescence, surface physics and solid-state chemistry. He thought that further discoveries would come from a careful study of the fundamentals.

Dr. W. B. Shockley, principal of the Shockley Transistor Corporation, discussed the lateral resistivity in the base layer and whether a large semiconductor area could be efficiently operated with uniformity over the whole area. A fuller report of Dr. Shockley's lecture and the other papers and discussions given at the convention will appear in our next issue.

A vote of thanks to the opening lecturers was proposed by Mr. G. Millington, chairman of the Electronics and Communications Section of the Institution of Electrical Engineers.

Dr. Brattain delivering his lecture at the opening session of the convention

VIEWS on the NEWS

By REFLECTOR

MY reference to the halfpenny overcharge on electricity accounts has drawn the suggestion from Mr. A. J. Abbott, A.M.I.E.E., of Thames Ditton, Surrey, that it should be the practice to charge to the nearest higher penny in spring and autumn and to the next lower penny in the other two quarters. But what about those consumers whose accounts come to an odd halfpenny only in the spring and autumn periods? In the olden days drapers used to give a packet of pins instead of a farthing change. Perhaps the Electricity Boards could follow suit and give the consumer a length of fuse wire for his odd halfpenny.

* * *

Always I look hopefully at the reports of sectional meetings of the Electrical Power Engineers' Association in that body's journal and I am seldom disappointed. I extract the following cryptic passage from one of these reports in the May issue of the *Electrical Power Engineer*:

> "Arising out of its minutial sepulchre came the hardy old hostel stand-by. This was due for final submission early in March and the ghost retreated again to sundry growlings."

I can only think that this has something to do with a haunted inn—but I can't imagine why?

* * *

I recently questioned a statement in *Electron*, the journal of the Electrical Trades Union, that the increased self-finance of the electricity supply industry would have to be provided by the workers in the industry. I suggested, obliquely, that the consumers were the people who would have to find the extra money. Very courteously, in its May issue, *Electron* develops its argument at some length in order to convert me to its point of view, but after careful reading I am still unconvinced. After pointing out that the £1,030 to be found by the industry from its internal resources can come only from the production of the workers in the industry, *Electron* says:—

> "'Reflector' may say that, even if this is true, nevertheless it is only the consumer that can transform the values the workers produce into cash. This, again, we do not deny. But the consumer is buying values he himself has not produced. If the consumer is a wage or salary earner or a producer of values, then he is exchanging values for values. But if his income is derived from rent, interest and profit, he is consuming values that others have produced."

I should have thought that the vast majority of electricity consumers were wage or salary earners, but I will concede that *Electron's* arguments are valid in so far as workers in the industry are electricity consumers, as they undoubtedly should be.

* * *

In the same issue of *Electron* there is an account of the building of the church of St. Mark, Biggin Hill, Kent, for which the E.T.U. has provided one of the windows; the Union's badge is incorporated in the design. Much of the work in the building was carried out by the vicar, the Rev. V. Symons, but I am glad to read that the electrical installation was one of the jobs which he preferred not to tackle and this part of the work, it is reported, "was undertaken by the C.E.A."—presumably the Electricity Board.

* * *

As a rule electric fires get into the news only when they are responsible for serious accidents or fatalities. Consequently it is a change to come across the lighter touch, as in this recent paragraph in *The Times*:

> "Proceedings were interrupted during a debt case at Bristol County Court yesterday when a solicitor discovered that his gown had been set alight by an electric fire. When he apologised for creating a disturbance the Registrar, Mr. L. H. D. Hodges, said he was only too glad to have some interest introduced into the case."

* * *

Dim lights, slow cookers and inoperative television sets are fairly frequent phenomena in some rural (and other) areas where overloading reduces voltage. But see how they suffer at Sidmouth. A member of the Urban Council asserted at a recent meeting that

> "in the mornings my electric razor refuses to work properly. It takes the whiskers out one by one instead of doing it at speed."

Another member recalled that before nationalisation the electricity authority had to maintain the correct voltage, but apparently a nationalised industry could do anything. "They can give us two candle power and call it 240 volts and get away with it." Yet another member said:—"We get too much current in our part of the town. Our bulbs keep popping."

* * *

Having regard to recent happenings in the British cable-making industry the following passage from the *Electrical Review* of half-a-century ago (28th May, 1909) makes interesting reading:—

> "It has required scarcely more than three months of open competition in the cable manufacturing trade in Germany to bring the makers to a decision to reconstitute the syndicate for the inland market. The combination was dissolved early in February, in consequence of the inability of the constituents to arrive at an agreement with an outside competitor, as represented by the Bergmann Electricity Works Co., which recently started the production of cables for lighting and power purposes, and which demanded as a condition of its association with the syndicate a tonnage allotment in the whole of the trade, which the then members of the syndicate were not prepared to concede. Under the circumstances the syndicate collapsed, and the rivalry which immediately ensued became so keen that the prices of cables for heavy work declined, it is said, even to 30 per cent less than the cost of production. The result of the cutting is now indicated by the announcement of the re-formation of the syndicate with the addition of the formerly outstanding firm as a constituent."

The World Bank

THE annual lecture of the Supply Section of the Institution of Electrical Engineers was delivered on 20th May by Mr. P. J. Squire, M.I.E.E., assistant technical director of the Operations Department of the World Bank. His talk was entitled "The World Bank—What it is and what it does."

The World Bank and the International Monetary Fund were conceived at the Economic Conference held in 1944 at Bretton Woods, New Hampshire. They both had the status of special agencies of the United Nations, and the same member countries, but played quite different roles. The Fund had the purpose of providing assistance to enable member countries to overcome short-term difficulties which threatened the stability of their currencies. The World Bank, on the other hand, made medium- and long-term loans to the member countries in the currency of the governments concerned, and the loans were to assist in the economic development of those countries. The World Bank did not lend until it was satisfied that sound economic and monetary policies were being followed.

Present membership of the Bank totalled 68, which included only one Communist state, Yugoslavia. The present authorised capital was $10,000 million and the total capital subscriptions amounted to $9,600 million. The capital subscription of each nation was determined in relation to its economic strength and was divided into three parts: 2 per cent had to be paid in gold or dollars when the country joined, a further 18 per cent was subscribed in the country's own currency and the remaining 80 per cent was not paid in and was not available for the Bank to lend. It would be subject to call only in the unlikely event that the Bank was unable to meet its obligations.

In addition the Bank had been able to sell bonds in the capital markets of the world at reasonable interest rates on the strength of its reserves and the guarantee represented by the uncalled 80 per cent of members' subscriptions. Outstanding borrowings were equivalent to $1,840 million at the end of March. By selling from its own loan portfolio wherever possible, the Bank had been able to increase its reserves for further lending by nearly $500 million.

At the end of March, 226 loans had been made totalling more than $4,300 million. The Bank had helped to finance more than 600 projects in some 49 countries. The periods of the loans varied with the type of project. For power projects, the term was usually 20 years for thermal plant and 25 years for hydro plant, the terms for other projects usually being much shorter.

The distribution of loans geographically was 30 per cent to Europe, 30 per cent to Asia, 20 per cent to Latin America, 13 per cent to Africa and 7 per cent to Australia. The largest borrower was India, which had received more than $500 million. At present, the Bank made loans at the rate of over $700 million a year, and it was thought that the rate would increase. About a third of the total lending had been for power projects and, in fact, the Bank had helped to finance more than 9,000 MW of generating plant.

Once the Bank had satisfied itself that a country was credit-worthy, the next thing was to make sure that the scheme was sound, and that was Mr. Squire's main interest as a project appraiser. The Bank wanted to be satisfied that the project had high priority in the economic development of the country concerned. That was not always easy to determine because the profitability of any project was not necessarily a measure of its full contribution to the economic growth of the country. Then the Bank wanted to be satisfied that the technical, financial and administrative plans for the project were satisfactory. It was necessary to know that the engineering plans had been drawn up competently, that the project was suitably designed and that construction would be entrusted to competent hands and would be properly supervised. Contractors were selected by the borrower and the Bank did not influence the choice. It had been found in project appraisal that one of the most important aspects of any project was management and the organisation of the agency which would operate it. A requirement was that such an agency should have power to make its own decisions, to create its policy and manage its affairs without outside interference. That seemed obvious, but on several occasions the Bank had found it necessary to insist on the establishment of such an agency with the passing of legislation to achieve it.

After making a loan, the Bank's interest in the project did not cease. It followed closely its construction, the expenditure on it and, after completion, its operation. The Bank also closely watched the financial situation of the borrower and the development of his business.

Mr. Squire concluded his lecture by showing a number of slides of the Binga hydro-electric project in the Philippines in respect of which the Bank had made a loan.

NEWS FROM SOUTH AFRICA

From a Correspondent

CAPE TOWN'S new £12,500,000 municipal power station at Athlone is rapidly taking shape. The steel framework of the 160ft high building is almost finished and the foundations are in for the first of two chimneys, each 320ft high. Unlike the Table Bay and Salt River power stations, which have their coal supplies stacked in the open, Athlone power station will have a £330,000 store to hold 30,000 tons of coal. Later this year, when the peak of construction is reached, about 20 main contractors and many sub-contractors will be at Athlone with more than a thousand workmen on the job. The building of the power station, eventually to house six turbo-alternators and eight boilers, is being done in three stages. The first stage, to house three sets, is now under way. In July, material will arrive for the extension of the building for two more turbo-alternators. The third stage will be reached in about 1966 when the sixth and last machine starts generating. The city electrical engineer said recently that if present progress was maintained the first turbo-alternator should be ready for trials about the end of next year. It would be necessary for the City Council to consider building another power station in 1963 or 1964.

A 30-ton 10,000 kVA melting furnace built in South Africa under the direction of Efco (South Africa) (Pty.), Ltd., for the steel foundry of the Vanderbijl Engineering Corporation, Ltd., is believed to be the largest in the Southern Hemisphere used in the production of steel castings. It is of the Efco-Heroult direct-arc, swing-roof type with a 10,000 kVA three-phase OFW externally water-cooled transformer and Efco-Rotodyne regulator incorporating a magnetic amplifier. It has electrically controlled slagging and side doors. The 15ft 6in diameter shell of the furnace has a nominal capacity of 67,000 lb, but where the demand is rather greater it can be used to melt up to 90,000 lb.

X-Ray Conference

A CONFERENCE will be held on X-ray diffraction and spectrography in conjunction with the Department of Chemistry at the Imperial College of Science and Technology, London, S.W.7, from Monday, 6th July, to Friday, 10th July, inclusive.

The conference will discuss and evaluate modern techniques and instrumentation for diffractometry and fluorescent analysis. An extensive range of modern equipment will be available for demonstrating the principles of these methods over a wide field of applications. Sample preparation and presentation together with the use made of electronic analytical information will be discussed in relation to the requirements of industry.

Full information concerning the conference together with details of the registration fees may be obtained from the Conference Secretary at Research & Control Instruments, Ltd., Instrument House, 207, King's Cross Road, London, W.C.1.

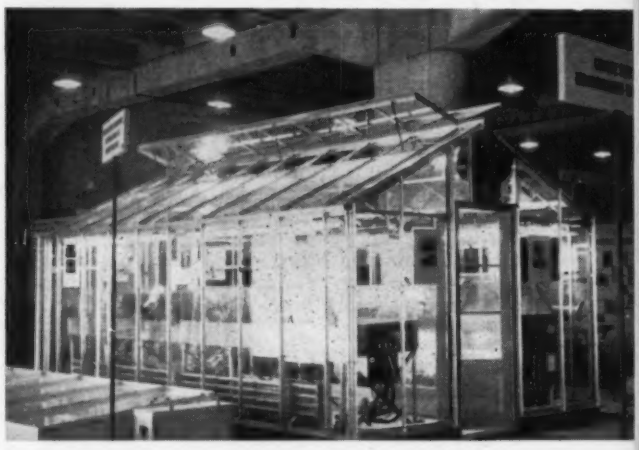
The Automatic Greenhouse

CHELSEA FLOWER SHOW EXHIBIT

ONE of the five exhibits staged by the British Committee for Overseas Flower Shows at the International Floralies held in Paris recently was a fully electrical automatic greenhouse and ancillary frames shown in the Scientific Section, the exhibit winning second prize in its section. This exhibit, together with other electrical applications, has this week formed a part of *The Times* exhibit "The Garden of Tomorrow" at the Chelsea Flower Show, and later will be on the Southern Electricity Board's stands at the Bath and West Show, Yeovil, 3rd to 6th June inclusive; at the Royal Counties Show, Portsmouth, 24th to 27th June inclusive; and on the South Wales Electricity Board's stand at the Royal Welsh Show, Port Talbot, 22nd to 25th July inclusive. The exhibit, which consists of an aluminium-framed and fully glazed greenhouse 18ft long by 10ft 6in wide and three adjoining frames, each 5ft by 5ft, is equipped with the latest electrical apparatus for providing automatically controlled environment.

The greenhouse layout follows the traditional pattern having a bench along the south side and an open border and an enclosed propagating case on the north side. Space heating is provided by two banks of four 16ft long horticultural tubular heaters loaded at 60 W per foot run. Control of the space heating temperature is basically by a rod-type thermostat, modified in this case to provide automatic setting of the thermostat to give a night temperature 10 deg lower than the day temperature. Based on work recently carried out in Germany, "cycling" of the thermostat is provided by a small motor unit giving one revolution in 24 hours. Operating through a short arm connecting the motor to the setting screw of the thermostat, the setting is altered by 10 deg F during one 12-hour period and re-set during the next. To give the higher temperature coincident with the maximum natural light the maximum setting is at 12 noon, dropping by 10 deg F during the next 12 hours, giving the lowest setting at 12 midnight, and re-setting to the maximum temperature during the following 12 hours. Ventilation is by a 12in extractor fan fitted with automatic louvres and controlled by a rod-type thermostat. Protection against pests and diseases is provided by a small electrically heated unit containing the appropriate insecticide or fungicide which, when heated, is given off into the atmosphere in a continuous stream of particles or aerosols.

For exhibition purposes the whole of the bench is shown as a propagating bench having 9in side walls of aluminium sheet and a base of corrugated asbestos. On this has been placed a 4in bed of sand warmed by mains voltage cables. On one half of the bench the mist propagating technique is demonstrated. Cuttings rooted in full daylight are kept covered by a thin film of water from an intermittent mist spray by a sensing element placed amongst the cuttings and operating a magnetic valve through a transistorised control unit. On this section a further automatic control to provide "weaning" for the rooted cuttings is also shown, gradually reducing the amount of misting. The mains voltage cables in this portion of the bench give a loading of 15 W per sq ft to provide a root temperature of 75 deg F. On the other half of the bench automatic watering is provided through spray nozzles. This application of water differs from mist propagation as no attempt is made to keep cuttings, seedlings and pot plants covered by a film of water but only to replace the water lost from the compost or soil by evaporation or taken by the plant. The frequency and duration of the water applications are governed by the moisture loss from a ceramic block having equivalent evaporative properties to that of medium loam and which evaporates water from the two electrodes of a "sensing" element. As the water film between these two electrodes is broken a magnetic valve is opened and the automatic watering operates sufficiently to replace the moisture in the soil and ceramic block. The duration of the application is governed by a drip feed into a small container in which is fixed an automatic siphon. As the water in the container reaches the top of the "U" tube it siphons



Above: The automatic greenhouse exhibit

Below: Enclosed propagating case and "growing cabinet" on the north side

into the tray containing the ceramic block and also runs into the slot containing the sensing element, re-forming the water film between the two electrodes, causing the magnetic valve to close and the water spray to cease. This automatic watering device also controls the watering of the open border, the water being applied through a perforated " Alkathene " tube laid along the surface of the border between the rows of plants.

Root warming on the bench is provided by mains voltage cables at a loading of 7½ W per sq ft, and in the open border by low-voltage equipment fed from a transformer, also at this loading. Control of the root temperature in both sections of the bench is by a rod-type thermostat inserted in the sand base, but for the open border the control is by hand switching under the " dosage " system of 12 hours on—during the night—and 12 hours off. In the exhibit an electric pump taking water from an open tank is used to provide the 60 p.s.i. pressure required for the fine mist from the spray nozzles.

In the enclosed propagating case the root and air temperatures are provided by mains voltage cables in the soil and in the air, the air temperature being controlled by a rod-type thermostat and the root temperature by hand switching from observation of a thermometer placed in the sand bed. The loading of the air and bed warming cables is sufficient to give a 15 deg F temperature rise over the corresponding greenhouse temperatures.

A feature of this exhibit is the provision of a " growing cabinet " built into the legs of the enclosed propagating case. In this cabinet, which is 6ft long by 2ft 9in wide by 3ft deep, all the environmental factors are provided electrically. The space heating is by mains voltage cables fastened to the bottom of a wire grid which forms a false floor in the cabinet some 6in from ground level. This heating is controlled by a rod-type thermostat as is the automatic ventilation provided by an inlet fan blowing air in through the false floor. The air leaves the cabinet through louvres at the top. Lighting is provided by four 5ft 80 W warm-white fluorescent tubes and provision is made for the insertion of either one or two 25 W tungsten lamps to give some degree of colour correction where more red light is required. The periods during which light is provided, that is the day length, are controlled by a solar-type time switch.

Supplementary light is provided for the whole of the greenhouse by four rows of two 8ft 200 W warm-white fluorescent tubes controlled through a photo-electric cell, the supplementary lighting being switched on when the natural light falls below a value of 300 lumens per sq ft. A solar-type time switch is used to contain this supplementary lighting within the natural day length.

The electrical installation was originally carried out in m.i.c.c. cable with a plastic sheath, but this is now being replaced by a more flexible type of cable as the exhibit has to be dismantled and re-erected a number of times during the coming season. The installation is controlled from a master panel in which each circuit is provided with earth leakage protection, the circuits energised being indicated by neon lamps.

The frames follow the more traditional uses. In one low-voltage 7½ W per sq ft equipment, soil warming is provided for the growing of salad crops, controlled by hand switching on the " dosage " system. The second is equipped as a propagating frame with mains voltage cables providing air and root heating, the air warming being controlled by a rod-type thermostat and the root temperature by hand switching from observation of a thermometer placed in the sand bed. The third frame is supplied with frost protection by thermostatically controlled mains voltage cables, no bottom heat being provided as this frame would normally be used for hardening-off plants for the greenhouse and for the overwintering of dormant stock.

An electrical soil steriliser is also shown as ancillary equipment to the greenhouse.

N.P.L. REPORT

THE recent reorganisation at the National Physical Laboratory and the consequent new trends in its research work are outlined in the annual report for 1958, published for the Department of Scientific and Industrial Research by H.M. Stationery Office, price 8s.

The replacement of three old divisions by the new Applied Physics, Basic Physics and Standards Divisions has enabled the laboratory to plan research into new fields. The new Basic Physics Division is being equipped to begin work mainly devoted to the relation between the macroscopic properties of materials and their structure on a molecular scale. Work has begun in the Applied Physics Division on radio-carbon dating, and a national centre for neutron source standardisation is being formed. A new item in the Standards Division is the accurate determination of the gyromagnetic ratio of the proton which will lead to the precise measurement of strong magnetic fields and hence to the accurate determination of a number of important fundamental constants. Other new aspects of the programme include the increasing attention of the Aerodynamics Division to the behaviour of gases at the high temperatures associated with high-speed flight, and to the development by the Control Mechanisms and Electronics Division of new components for very-high-speed computers.

The Light Division has made progress with the application of gratings to linear and angular measurement and to the control of machine tools, and the Metallurgy Division has been concentrating particularly on fine structures of metals, movements of dislocations and their relation to physical and mechanical properties. A group is being set up in the Mathematics Division to consider the theoretical aspects of experimental work being carried out in other divisions.

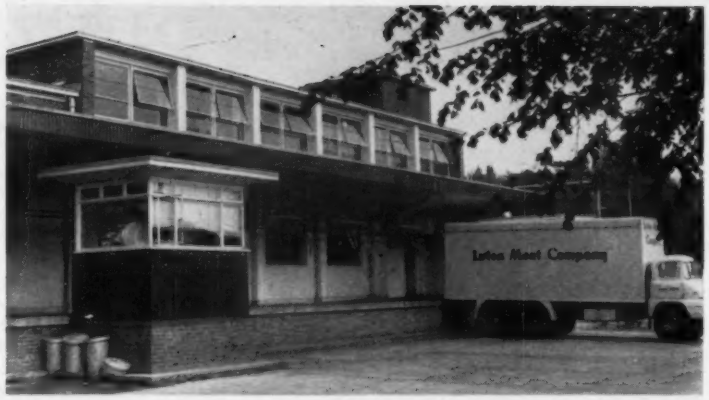
In future greater attention will be given to problems connected with the seagoing qualities of ships in rough water. This work is being carried out in co-operation with the British Shipbuilding Research Association, the Admiralty, and the National Institute of Oceanography. Staff are already at work in the new ship hydrodynamics laboratory, which is nearing completion at Feltham. It is hoped that the laboratory will be in full use by the end of this year.

ELECTRIC IRONS

Next week's issue of the *Electrical Review* will contain an illustrated survey of domestic electric irons. Details included, in tabular form, will cover weight, loading, special features, finish and price, with manufacturers' names and addresses

SMITHFIELD HOUSE

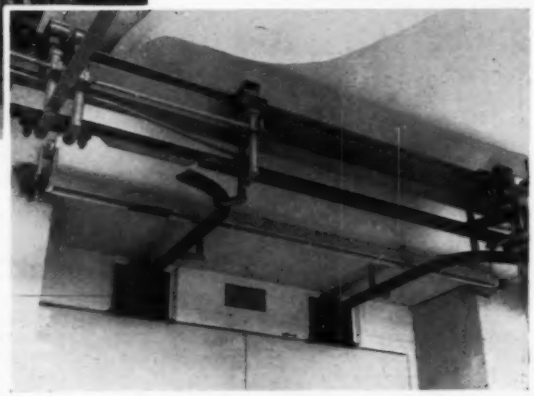
OPENING OF A LARGE COLD STORAGE PLANT AT LUTON



Loading bay showing one of the weighing offices

LAST Monday Smithfield House, the headquarters of the Luton Meat Co., was officially opened by Dr. Charles Hill, M.D., M.P. The building contains a freezer and a refrigerated sales room where local butchers are able to buy their meat and poultry under modern hygienic conditions. The meat received from the abattoir is placed on a hook which is hung from tubular overhead rails and conveyed manually to the sales hall. If the meat is not sold that day or has to be stored, it is then conveyed to the freezer.

Before the meat is displayed in the sales room, it is weighed, coded, numbered and dated. This weighing installation, supplied by Berkel Auto Sales, Ltd., consists of four specially designed units housed in two separate weighing offices in the loading bay. These offices contain the working heads and the automatic printing mechanisms of the scales.



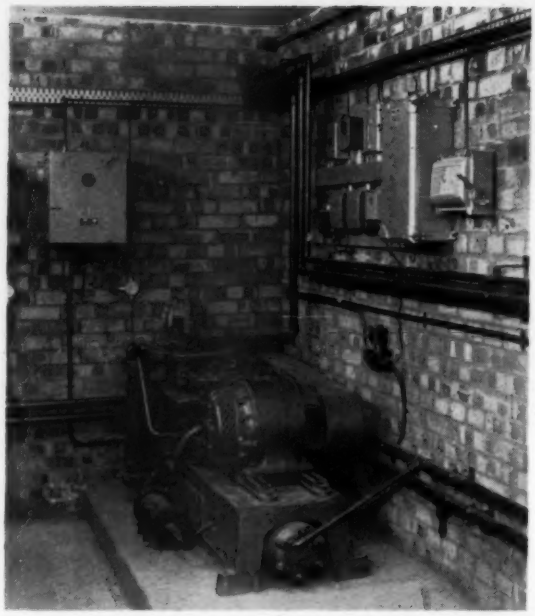
Above: Refrigerated sales hall. Right: The outlet for the air curtain above the sales hall entrance

The refrigerated sales hall occupies a floor area of 15,000 sq ft and is lit by Crompton Parkinson flush twin tube fluorescent fittings with "Perspex" panels. So that this artificial lighting should not affect the appearance of the meat, de-luxe warm white tubes are used together with 150 W tungsten lamps in adjustable bulls-eye fittings. The walls are painted a light shade of green to help with colour rendering. At the entrance to the sales hall, an air curtain is operated whenever the door is opened. This disposes of the need for air locks and prevents warm air from entering the room.

The freezer adjoins the main sales hall and has been designed with two levels of storage. Its capacity approximates 8,000 cu ft and the maximum use of space allows for the storage of around 100 tons of carcases at one time. Soil heating cables have been laid underneath the freezer room to avoid "frost heave."

A cutting room has been provided for those butchers who do not require whole carcases. The bulk of the cutting is carried out on a heavy duty electric meat cutting machine supplied by J. C. Wetter & Co. It is powered by a 6 h.p. motor and can accommodate the largest of beef carcases. The cutting room itself is maintained at an equable temperature under all external conditions.

The whole of the refrigeration installation has been carried out by the Bedford Refrigeration Co., Ltd. Over the sales hall there is a false ceiling forming ducts in which five Prestcold UCS1200 coolers are fitted. These ducts have special diffuser grills for the inlets and outlets as well as an adjustable by-pass to maintain the air



Part of the compressor room

flow to the conditions required. These coolers are served by one 6 h.p. and one 5 h.p. water-cooled Prestcold condensing units.

Two Prestcold ED2400 cooling units are mounted in a mezzanine section in the freezer room. These are served by a 7½ h.p. condensing unit and they maintain a temperature of 10 deg F in the freezer room. A separate offal and poultry room is cooled by a 3 h.p. condensing unit which maintains a constant temperature of 35 deg F. The compressor units for the operation of all the refrigeration equipment are situated in a special room at the rear of the building.

Mineral insulated copper covered cables in ducts are used throughout because of condensation due to the considerable variations in temperature throughout the building. Eight socket outlets for battery charging and anti-frost heaters for lorries are provided at the loading dock. The main entrance and exit gates are electrically operated and six 15ft A.E.I. "Ashley" lanterns have been provided for outside lighting. The electrical installations have been carried out by the Shoolbred Electrical Co., Ltd., of Luton.

A.P.L.E. CONFERENCE

THE annual conference of the Association of Public Lighting Engineers will be held this year at Aberdeen from 15th to 18th September. At the opening session Mr. Ronald Parker, superintendent of lighting, Aberdeen, will be inducted as president, and at the annual luncheon on the following day the principal guest will be Lord Forbes, the Minister of State for Scotland.

To mark the jubilee of the Illuminating Engineering Society, the president, Mr. C. C. Smith, will present a paper on "Fifty Years of Lighting." Other papers will deal with craftsmanship and town planning in relation to public lighting, and practical aspects of street lighting column and lantern erection. There will also be the usual comprehensive exhibition of street lighting apparatus and equipment and an outdoor display of lamp columns and mobile equipment.

Technical Education in Germany

TWO papers on technical education in this country and Germany were presented at a joint meeting of the Institutions of Mechanical and Electrical Engineers at Savoy Place last night. One, by Mr. D. B. Welbourn, M.A., Professor D. B. Spalding, M.A., Ph.D., and Mr. G. L. Ashdown, entitled "Engineering Education at the Technical Universities in Western Germany," was based on a report submitted to the Lord President of the Council and to the Secretary of State for Foreign Affairs, at whose suggestion and under whose auspices a team visited Germany to attempt to establish a comparison between the academic levels achieved in higher engineering education in Great Britain and in Western Germany. The field of investigation was deliberately limited to the teaching of mechanical and electrical engineering at the Technische Universität, Berlin, and the Technische Hochschulen at Munich and Aachen. The team concluded that the German engineering educational system was not superior to the British when the graduate apprenticeship of the latter was taken into account.

The other paper was based on the report of a group of German professors who visited London, Rugby and Cambridge and was entitled "Problems of Engineering Education." This report was restricted to a tentative comparison of the English and German methods of organising engineering education at university level. The fact that English universities were able to concentrate on the training of engineers with a firm grounding in basic science principles while, in the engneering departments of the new colleges of advanced technology, engineering studies were directed more towards practical subjects, was thought to be a good approach to the problem in view of the necessary limitation of time devoted to study. All German technical universities had a uniform curriculum for the respective fields of engineering while the English universities were in a position to develop special characteristics and to impress upon their academic examinations a different accent and a different standard. Since the English universities did not claim to provide a full engineering training, they were able to adapt themselves easily to the rapidly developing trends of modern science.

British Educationists to Visit Germany

A PARTY, which will include university professors from Cambridge and London, members of education committees and college boards of governors, education officers, principals and lecturers from technical colleges, industrial education and training officers, and representatives of employers' federations and trade unions, is to visit Germany from 1st to 5th June to study the German system of technical education. Based on Düsseldorf, the delegates will visit engineering firms in the Ruhr to study modern methods used in the training of German technologists. Visits will also be made to the technical university (Technische Hochschule) at Aachen, the University of Bonn, a vocational training institute, an art academy, a town planning institute, and the headquarters of German employers and trade union federations. At a reception given at the Ministry of Education for North Rhine-Westphalia on 2nd June, delegates will be welcomed by the Minister, and will hear an address on developments in German technological education. The conference is being organised by the London and Home Counties Regional Advisory Council for Technological Education in co-operation with the Federal German Embassy in London, and the German Academic Exchange Service. The party will include a number of electrical men who are interested in technological education.

OVERSEAS ELECTRICAL TRADE

Exports Rise to £22·6 Million in April

SHIPMENTS to the United States of wires and cables, principally submarine telephone cables, worth nearly £3 million, were largely responsible for total electrical exports in April achieving a peak of £22·6 million. Exports during the first four months of this year were £78·4 million, which is over 2 per cent higher than in the corresponding period of 1958.

Apart from the large increase in the exports of wires and cables, the other main classes of equipment which increased last month were rotating machinery, converting machinery, transformers and switchgear. Exports of radio apparatus and telephone and telegraph equipment were slightly lower than in March. On the other hand, radio apparatus and wires and cables were the only main classes of equipment to attain a higher total of exports in the first four months of 1959 than in the corresponding period of last year. Among domestic appliance exports, which were generally below the level of a year ago, an

TABLE I.—ELECTRICAL EXPORTS

Class	Month ended 30th April, 1959	Four months ended 30th April, 1958	Four months ended 30th April, 1959
	£	£	£
Generating sets and generators:			
Diesel-driven, up to 10 kW	86,333	562,949	404,061
Ditto, 10 to 65 kW	93,035	735,921	615,748
Ditto, 65 to 200 kW	158,805	764,468	648,169
Ditto, over 200 kW	469,134	1,321,491	1,261,183
Spark ignition engine driven	9,075	49,597	51,028
Steam turbine driven	8,578	319,705	300,229
Hydraulic turbine driven	—	—	—
Other prime mover driven	10,194	47,891	118,692
Generators, not exceeding 200 kW	98,793	579,602	408,058
Ditto, over 200 kW	114,467	379,621	384,064
Parts of generators	842,879	3,208,801	2,375,875
Motors, complete, other than railway, tramway and trolley-bus:			
Up to ½ h.p.	154,735	607,648	560,731
Over ½ but under 1 h.p.	40,732	239,133	180,055
1 h.p. to 250 h.p.	440,904	1,962,705	1,760,983
Over 250 h.p.	263,314	481,566	748,685
Railway, tramway and trolley-bus motors complete and parts of all motors	165,445	886,402	711,059
Motor starting and controlling gear	330,907	1,115,609	1,326,567
	3,287,330	13,263,109	11,855,187
Converting machinery	49,781	149,575	124,537
Mercury-arc rectifiers	51,816	411,876	205,082
Transformers for lighting, heating and power (incl. coils):			
Not exceeding 7,500 kVA	390,011	2,704,472	2,086,367
Over 7,500 kVA	395,058	1,414,897	1,723,268
Switchgear and switchboards (not telegraph or telephone), up to 200 A and 660 V	347,820	1,817,158	1,342,142
Ditto, other	1,350,533	4,062,644	4,920,100
	2,585,019	10,560,622	10,401,496
Primary batteries:			
Lighting	103,310	359,748	407,851
Radio	340,489	1,141,936	1,407,256
Other	29,761	193,205	154,585
Parts (excl. carbons)	44,922	185,564	173,108
Lamps:			
Filament, exceeding 28 V	96,639	352,978	352,854
Ditto, under 28 V	30,250	115,227	127,882
Arc lamps and searchlights	30,134	62,732	67,266
Discharge lamps, fluorescent tubes, etc.	85,655	349,569	384,260
Radio and television, etc., apparatus:			
Thyratrons, hot cathode mercury vapour and gas-filled rectifiers (excl. mercury-arc rectifiers), photo-electric cells, stabilising and cold cathode valves, magnetrons, klystrons	58,130	110,389	162,950
All other*	524,157	1,529,756	2,169,283
Parts (excluding glass bulbs)	33,475	66,221	109,698
Radio and television transmitters	337,982	217,396	434,972
Commercial radio and radar equipment	1,566,392	5,080,989	6,598,608
Domestic radio receivers, mains	115,282	350,925	433,493
Ditto, battery	47,128	208,318	230,618
Ditto, other (incl. car)	33,159	104,091	106,438
Radiograms	25,871	151,755	108,651
Television sets	32,229	483,363	276,342
Public address equipment	101,716	437,395	395,268
Other radio and television apparatus, n.e.s.	46,802	130,954	264,928
Components and parts, n.e.s.	791,991	3,078,254	3,127,433
	3,714,314	11,949 806	14,418,682
Telegraph and telephone installations	759,118	3,379,453	2,964,887
Telephone instruments, separately consigned	107,848	831,202	403,871
Telegraph and telephone parts	777,435	3,086,105	3,190,695
Line apparatus for long distance communication	133,757	770,812	752,021
	1,778,158	8,067,572	7,311,474

Class	Month ended 30th April, 1959	Four months ended 30th April, 1958	Four months ended 30th April, 1959
	£	£	£
Cookers	37,568	194,661	145,660
Toasters	27,580	91,760	77,398
Other cooking apparatus	31,756	148,767	129,528
Parts and accessories	82,716	239,658	325,574
Space heating appliances	22,718	174,300	86,251
Water heating appliances	28,322	106,239	118,710
Other heating appliances	25,773	170,318	102,173
Parts and accessories	82,567	235,897	295,727
Irons	62,927	327,723	255,944
Arc welding equipment, a.c.	74,626	352,281	173,907
Ditto, d.c.	64,116	174,984	233,048
Resistance welding equipment	114,880	57,658	161,626
Electric furnace plant	95,525	303,993	380,102
Magnetos, ignition	13,407	67,325	46,314
Sparking plugs	182,347	585,180	593,400
Elec. appliances for aeroplanes, n.e.s.	357,963	1,093,553	1,383,189
Ditto, for motor vehicles, n.e.s.	385,831	1,660,707	1,591,152
Ditto, for cycles, n.e.s.	35,677	226,423	154,646
Signalling app. (incl. traffic signals)	176,768	662,445	723,082
Instruments, commercial	185,952	708,179	754,514
House service meters (including parts)	116,866	646,959	493,873
Electro-medical apparatus (not X-ray)	33,695	175,735	127,805
X-ray apparatus (excl. tubes and valves)	33,837	239,484	148,457
Ceiling fans, complete	63,084	421,801	344,092
Desk fans, complete and parts of desk and ceiling fans	14,822	106,234	52,121
Vacuum cleaners	126,376	580,870	550,424
Floor polishers	83,642	278,146	294,522
Food mixers	107,209	218,757	327,952
Hair clippers and dry shavers	29,140	199,967	133,239
Other portable appliances	28,977	77,903	90,773
Parts	123,186	463,776	430,785
Portable elec. tools (not saws) and parts	210,342	913,870	802,104
Cables and wires:			
Telegraph and telephone, submarine	3,013,138	242,746	3,062,440
Ditto, other	400,698	2,293,479	1,704,071
Cotton, silk or art. silk insulated	19,427	184,958	83,476
Enamel, glass or asbestos insulated	109,468	294,139	379,122
Paper insulated	546,509	2,527,974	2,322,281
Rubber insulated	298,162	2,044,340	1,207,140
Thermoplastic insulated	289,764	830,608	882,410
Other	153,773	972,034	687,483
	4,830,939	9,390,278	10,328,423
Accumulators for motor vehicles	177,050	616,055	578,042
Ditto, traction	19,579	92,776	82,772
Ditto, radio and other portable	37,170	210,358	100,314
Ditto, other	75,099	110,213	255,443
Parts and accessories	108,429	454,468	314,560
Electric wiring accessories	205,677	563,870	749,702
Elec. ceramic ware, etc. (incl. insulators), n.e.s.	116,089	400,634	432,863
Insulating cloth and tape	45,759	198,852	192,934
Other insulating material	156,891	373,442	501,563
Permanent magnets	39,283	210,760	170,224
Radio, telegraph and telephone testing equip., n.e.s.	168,594	254,777	527,596
Scientific elec. instruments (excl. telegraphic or telephonic, time recorders and time switches)	251,176	1,359,484	1,233,147
Electrical machinery, n.e.s.	36,484	298,207	149,477
Electrical apparatus and appliances, n.e.s.	1,176,354	3,572,109	4,220,541
TOTAL	22,630,749	76,613,904	78,427,594

* The figures for 1959 are not strictly comparable with those for 1958.

TABLE 2.—DISTRIBUTION OF EXPORTS (TABLE I)

Country	Month of April, 1959	Four months ended 30th April, 1958	Four months ended 30th April, 1959
	£	£	£
Gibraltar	9,761	124,006	41,726
Malta and Gozo	99,681	285,139	202,427
Cyprus	63,475	389,616	244,284
Sierra Leone	41,147	231,708	140,563
Ghana	200,192	623,555	775,911
Nigeria	503,709	1,423,116	1,920,283
Union of South Africa	1,672,335	7,171,217	5,974,793
Rhodesia and Nyasaland	742,254	1,847,565	2,299,292
Tanganyika	35,637	201,844	159,938
Kenya	132,762	581,504	620,285
Uganda	33,536	266,395	196,440
Mauritius	92,192	161,916	215,512
Aden	56,448	245,975	251,030
Bahrain, Qatar and Trucial States	62,473	391,775	404,110
Kuwait	177,526	695,069	764,853
India	1,686,621	6,350,449	6,629,804
Pakistan	279,899	1,014,094	1,096,186
Singapore	191,074	1,307,102	1,034,191
Federation of Malaya	228,805	1,153,535	1,089,804
Ceylon	165,708	529,471	788,189
British North Borneo	9,091	96,335	71,118
Sarawak	20,214	84,338	81,516
Hong Kong	515,832	1,245,696	1,623,024
Australia	1,577,329	7,051,306	5,786,559
New Zealand	789,944	4,765,281	3,388,622
Fiji	34,817	108,020	139,314
Canada	1,283,821	4,419,841	3,688,569
Jamaica	151,385	558,354	560,609
Barbados	28,193	114,468	137,819
Trinidad	144,016	470,570	474,051
British Guiana	62,453	219,281	336,076
Other Commonwealth countries	206,091	736,259	778,256
Irish Republic	245,039	1,145,242	1,095,986
Soviet Union	75,904	160,702	377,305
Finland	85,796	542,019	373,911
Sweden	529,661	1,915,908	2,110,684
Norway	160,424	908,178	748,470
Denmark	221,074	733,705	856,958
Poland	37,513	297,275	164,791
Western Germany	732,153	1,079,341	2,197,103
Netherlands	709,826	2,431,812	2,772,297
Belgium	272,711	1,299,236	1,391,434
France	193,931	1,654,991	1,076,037
Switzerland	234,257	596,781	673,578
Portugal	188,342	1,522,677	755,112
Spain	218,754	626,341	771,776
Italy	300,305	1,166,260	1,275,500
Austria	48,407	203,410	176,645
Yugoslavia	85,281	204,016	321,324
Greece	139,033	368,442	448,253
Turkey	161,468	506,403	325,156
Belgian Congo	41,088	150,661	164,546
Portuguese East Africa	29,718	97,084	82,652
Egypt	37,748	375,259	698,461
Libya	51,753	236,457	326,218
Morocco (excluding Tangier)	16,381	120,694	173,507
Sudan	122,340	341,904	394,764
Syria	24,927	94,016	81,399
Lebanon	36,938	234,264	209,537
Israel	143,264	423,302	445,435
Jordan	82,071	314,215	367,961
Saudi Arabia	94,964	320,986	246,648
Iraq	244,609	1,062,306	1,405,062
Iran	328,102	1,395,500	1,351,831
Burma	72,996	294,482	377,568
Thailand	107,327	681,285	440,010
Indonesia	9,037	161,051	71,132
Japan	46,644	189,431	255,488
United States of America	3,918,447	2,329,066	6,340,044
Cuba	6,238	357,880	125,414
Mexico	40,558	215,774	154,439
Colombia	7,133	179,226	92,945
Venezuela	370,894	1,595,573	1,488,620
Peru	30,087	146,495	89,268
Chile	48,044	142,410	446,726
Brazil	262,758	450,006	390,170
Uruguay	14,706	12,256	49,872
Argentine Republic	180,765	1,146,117	545,186
Other foreign countries	322,912	1,318,665	1,785,217
TOTAL	22,630,749	76,613,904	78,427,594

TABLE 3.—SOURCES OF ELECTRICAL IMPORTS

Country	Month of April, 1959	Four months ended 30th April, 1958	Four months ended 30th April, 1959
	£	£	£
Australia	21,226	184,479	153,003
Canada	81,195	314,857	287,438
Other Commonwealth countries	134,351	398,001	423,156
Irish Republic	72,488	295,564	311,734
Sweden	139,707	390,094	487,674
Denmark	49,869	174,039	203,762
Western Germany	646,270	1,722,228	2,202,667
Netherlands	531,464	1,491,831	1,893,247
Belgium	67,167	177,350	191,507
France	133,436	446,327	542,628
Switzerland	126,875	432,517	458,967
Italy	109,758	227,629	335,680
United States of America	882,463	2,469,695	3,265,699
Other foreign countries	478,799	473,482	875,798
TOTAL	3,475,068	9,198,093	11,632,960

outstanding success was food mixers which at £328,000 were 33 per cent higher than in January-April, 1958.

The welcome upward turn in exports in April is reflected in small increases in shipments to the primary producing countries including South Africa, Rhodesia and Pakistan, but the four-month totals of exports to these countries are generally below those of last year. Exports to Europe and North America are well above last year's level, those to West Germany having more than doubled.

The leading market for generating sets and motors in April was the United States (£427,380), followed by India (£378,110) and Canada (£308,320). Converting machinery, transformers, switchgear and rectifiers went mainly to Australia (£383,103), India (£356,577) and South Africa (£320,720).

West Germany (£416,453) continued to be the largest market for radio and electronic apparatus, followed by the Netherlands (£336,168) and Canada (£274,914). The largest shipments of telegraph and telephone apparatus were to South Africa (£278,412), Canada (£192,364) and Australia (£178,491). After the United States the main market for wires and cables was India (£251,770).

Imports of electrical goods rose sharply in April to £3·5 million compared with £2·8 million in March and £2·3 million in April, 1958. In the first four months of this year electrical imports totalled £11·6 million, 25 per cent higher than in the corresponding period of 1958. Particularly notable were the increases in imports from Italy, the United States and West Germany.

TABLE 4.—OTHER ELECTRICAL AND ALLIED EXPORTS

Class	Month of April, 1959	Four months ended 30th April, 1958	Four months ended 30th April, 1959
	£	£	£
Washing machines, electrically operated:			
Not exceeding 150 lb weight	353,107	1,444,566	1,104,266
150 lb to 250 lb	40,830	317,172	165,753
Parts	72,724	262,276	318,380
Electric locomotives (incl. battery types)	565,985	1,042,551	1,980,674
Diesel locomotives with electrical transmission	415,908	455,908	901,079
Welding electrodes:			
Ferrous	97,653	383,012	314,224
Non-ferrous	15,761	122,976	78,620
Electric conduit tubes and cased tubes	51,276	232,319	224,134
Electric carbons	101,089	199,988	386,147
Electric lighting fittings and lanterns (excl. arc lamps, searchlights and cycle lamps)	296,764	1,434,257	1,124,331
Electric fork-lift trucks	69,567	244,176	313,946
Water turbines	184,272	828,191	1,201,090
Steam turbines	1,629,494	2,642,898	4,739,071

TABLE 5.—ELECTRICAL IMPORTS

Class	Month of April, 1959	Four months ended 30th April, 1958	Four months ended 30th April, 1959
Generators, incl. parts	70,727	253,043	264,371
Motors, incl. parts	130,001	385,432	478,962
Convertors; transformers; rectifiers*	58,060	77,471	291,733
Switchgear and switchboards (not telegraph and telephone)	120,142	174,612	362,022
Cathode ray tubes, complete	89,497	259,070	321,565
Other valves, complete*	257,571	721,311	940,431
Parts (excl. glass bulbs)*	78,591	164,846	251,725
Radio receiving sets, domestic or portable	26,819	61,270	64,919
Radio communication and navigational aids, complete	411,005	1,053,861	1,409,562
Other radio and TV apparatus, parts and accessories	379,859	1,291,285	1,321,854
Apparatus for telegraphy and telephony	127,440	288,023	342,024
Welding machinery	89,861	76,077	201,397
Cooking and heating apparatus	283,390	491,536	654,913
Magnetos, ignition, and electric appliances for aeroplanes, motor vehicles and cycles	153,723	766,995	605,231
Electro-medical apparatus (incl. X-ray apparatus)	71,336	312,592	378,230
Portable mechanical appliances, electrically operated, complete	102,367	270,253	400,753
Parts	56,873	210,217	213,931
Scientific electrical instruments (excl. telegraphic and telephonic)	144,516	612,029	528,421
Other machinery, apparatus and appliances	823,290	1,728,170	2,600,916
TOTAL	3,475,068	9,198,093	11,632,960

* The figures for 1959 are not completely comparable with those for 1958.

INDUSTRIAL NEWS

Soviet-British Trade Agreement

After more than a week's negotiations between the Soviet authorities and the mission to Moscow, headed by Sir David Eccles, President of the Board of Trade, a five-year trade agreement was signed on 24th May. Details are not yet available but it is reported that there will be an exchange of consumer goods between the two countries and that Russia is interested in buying capital plant. It is also said that the United Kingdom will import Russian machinery under the agreement.

Russian Order for Landing Systems

Last week Marshal Zhigarev, head of Aeroflot, the Russian air line, placed orders with Pye, Ltd., for two of that company's aircraft landing systems. These are to be installed at the Moscow airport and their value is said to be about £100,000.

Request for Longer Holidays

Representatives of the unions present at a meeting of the National Joint Council for the Electricity Supply Industry on 21st May asked for a review of the present holiday agreement which provides for two weeks' holiday with pay for about 200,000 manual workers. The unions are seeking a third week's holiday and the question was referred to a negotiating committee.

Design Awards

The Duke of Edinburgh visited the Design Centre, London, on 15th May to see the sixteen exhibits chosen by the Council of Industrial Design as Designs of the Year for 1959 from the many hundreds which had been on display during the previous year. After touring the display and talking with the designers, Prince Philip presented manufacturers of the sixteen chosen products with certificates. He also announced the winner of the first "Duke of Edinburgh's Prize for Elegant Design" (Mr. C. W. F. Longman, B.E.M.) for his part in designing the Prestcold refrigerator, D.301 "Packaway." One of the sixteen awards was made to Atlas Lighting, Ltd., for its domestic fluorescent "Kitchenlight," Mr. A. Deutsch (chairman of Atlas Lighting, Ltd.), who was accompanied by John and Sylvia Reid, the designers, receiving the award from Prince Philip.

Illustrations of the winning designs appeared in our issue of 15th May (p. 911).

E.T.U. Funds

The annual financial statement of the Electrical Trades Union, covering 1958, shows a considerable improvement in the Union's finances. Total income from all sources was £783,104 and total expenditure £550,106, leaving a balance on the year's working of £232,998. This compares with a debit balance in 1957 of £77,521. The total amount in the general funds at the end of 1958 was £564,390, compared with £331,393.

National Education and Careers Exhibition

The emphasis at the Central Electricity Generating Board's stand at the National Education and Careers Exhibition, now in progress at Olympia, London, is placed on the training of apprentices and other entrants for careers in generation, transmission, research and development. One section of the stand is devoted to examples of the training of craft skills; here, demonstrations are given by apprentices of the tasks they perform during their basic workshop training. Examples of their work are displayed. Some of the functions carried out at the C.E.G.B. Research Laboratories at Leatherhead are illustrated in a second section of the exhibit, together with models of an atomic power station and a grid substation. Display panels describe the C.E.G.B. training programmes for apprentice craftsmen, engineers, chemists, administrative staff and education in the industry.

British Sealed Beams, Ltd.

British Sealed Beams, Ltd., was registered on 15th May with a capital of £1,000,000 to develop and manufacture all-glass light units for use in automobile headlamps and in other industrial lamps of similar construction. The factory will be at Corby, Northants., and production of the new unit is expected to begin in twelve months' time.

The A.E.I. Lamp & Lighting Co., Ltd., the General Electric Co., Ltd., and Joseph Lucas, Ltd., are partners in this venture. Manufacture of all-glass light units is carried out on highly specialised automatic machinery of high cost, and a large volume of output is necessary to justify the capital outlay and to manufacture at economical costs. For this reason the three companies have agreed to combine their total requirements in the single manufacturing unit. Very considerable technical advantages will also accrue from the combined specialised knowledge of the three concerns.

Accommodation at Bournemouth

As we have already reported, next year's British Electrical Power Convention is being held at Bournemouth from 30th May to 2nd June. Mr. J. W. Simpson, the Convention secretary, says it appears that a number of delegates have been unable to secure the accommodation they require. He believes that this is because too many people try to book at one or two of the leading hotels. There are numerous other first-class hotels which have not yet been approached and Mr. Simpson (whose address is 26-27, Cockspur Street, S.W.1) is willing to provide a list of them to any delegate who applies to him.

New Resins Plant

New buildings for CIBA (A.R.L.), Ltd., at Duxford, Cambridge, were formally opened on Thursday last week by Dr. R. Kappeli. This year also marks the 25th anniversary of the formation of the company which was incorporated in 1934 with the title of Aero Research, Ltd.; CIBA, of Basle, bought control in 1947.

The new buildings consist of a plant for the production of "Araldite" epoxy resins, a research block for fundamental research and additional wings to the sales offices, including a new display room. The main building for the "Araldite" plant provides a total working area on four floors of 16,300 sq ft. It includes 3½ miles of

The new "Araldite" epoxy resin plant of CIBA (A.R.L.), Ltd., at Duxford

pipework and 500 valves, and there are more than ten miles of electric wiring. Because of fire hazards, two ancillary buildings, the control laboratory and the switch house, have been built at a considerable distance from the main plant. On the east side of the building is a brick-built store with a floor space of 4,700 sq ft. A "tank farm" contains twelve main vessels with a total capacity of 50,000 gal.

The research block has a total floor space of 12,800 sq ft. The ground floor is devoted to long-term research and the upper floor to the investigation of current applications of the company's products. The new wings to the existing sales buildings have made more than three times the amount of floor space available for the sales and publicity divisions. The new buildings and other works have cost £500,000.

Following a tour of the new premises in the afternoon, the guests were entertained to dinner, at which Dr. N. A. de Bruyne (managing director) presided.

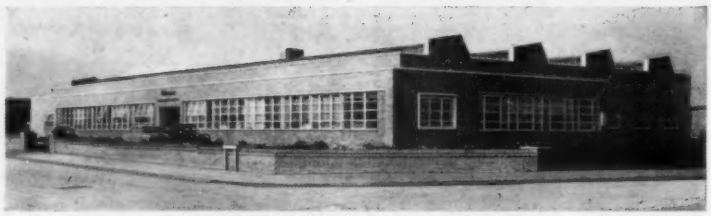
Home Freezing

The preparation of food for home freezing is the subject of the latest E.D.A. publication. Copies of the leaflet, which describes in a series of pictures the correct methods of keeping a variety of foodstuffs in perfect condition for future use, may be obtained from the British Electrical Development Association, 2, Savoy Hill, London, W.C.2 (ref. E.D.A.1823).

Electric Locomotives for South African Railways

The accompanying picture, taken at Durban Docks, shows the unloading of a Metropolitan-Vickers 2,200 h.p. electric locomotive for South African Railways. The locomotive is one of two recently dispatched from the Stockton Works of Metropolitan-Vickers–Beyer, Peacock, Ltd. Their arrival marks the commencement of deliveries on an order for 135 locomotives placed by the South African Railways administration with Metropolitan-Vickers South Africa (Pty.), Ltd., on behalf of the Metropolitan-Vickers Electrical Export Co., Ltd. The delivery rate is planned to reach five locomotives a month by the end of this year.

Metropolitan-Vickers electric locomotive being unloaded at Durban for the South African Railways



Advance Components, Ltd., factory at Hainault

Simmonds Aerocessories' Australian Extensions

New factory buildings were opened last month at Ballarat, Australia, for Simmonds Aerocessories Pty., Ltd., the Australian subsidiary of Simmonds Aerocessories, Ltd., a member of the Firth Cleveland Group. At the opening ceremony, performed by the Mayor of Ballarat, Mr. H. Hanford Stevens, managing director, announced that a further extension, covering 72,000 sq ft, would be built to link the new building with the old. In addition to the manufacture in Australia of "Spire" speed fastenings, Simmonds self-locking nuts and "Surform" hand tools, Simmonds Aerocessories Pty., Ltd., manufactures the range of "Gardenmaster" rotary cultivators and ancillaries for Landmaster Pty., Ltd., another member of the Firth Cleveland Group.

Hainault Factory

Last week we visited Advance Components, Ltd., now fully established in their factory at Roebuck Road, Hainault, Ilford, Essex, to see the production of their range of signal generators, instruments and attenuators, and some of the items of equipment under development. One of the best known products of the company, which was first registered in 1932, is the type E1 signal generator introduced in 1946, since when over 20,000 have been sold to universities, technical colleges and service engineers.

In 1945 the company acquired the manufacturing rights of constant voltage transformers from the Sola Electric Co. of America, and some 2,000 different designs of constant voltage units covering a range of output power requirements from 4 to 12,000 W have been completed, with others under development. The production of constant voltage transformers is now approaching 20,000 annually.

A wide range of signal generators has been produced since 1946, covering a frequency spectrum from a few to many millions of cycles per second, with "Q" meters, crystal calibrators, valve voltmeters, attenuators and stabilised power units. In 1958 nearly 4,000 instruments were sold, in addition to the large number of voltage transformers, some 25 per cent of the total output of Advance products being exported.

The factory and administrative offices now have a floor area of approximately 20,000 sq ft, and plans are in hand for the expansion of both departments, soon to be implemented.

J. H. Fenner in Australia

Mr. S. B. Hainsworth, chairman and managing director of J. H. Fenner & Co., Ltd., has announced the formation in Sydney, Australia, of a manufacturing company for mechanical power transmission goods by means of an association between the Dodge Manufacturing Corporation of Mishawaka, Indiana, and the Fenner Co. in Hull. The new company, now operating in a factory of some 20,000 sq ft floor area at Revesby, New South Wales, is owned as to 60 per cent of its capital by the Fenner interests and as to 40 per cent by the American associates in the venture. Although there has been widespread technical co-operation between the two companies for nearly ten years, this is the first occasion on which there has been any financial connection.

Industrial Television

The application of television to the industrial and commercial field has made possible the observation of processes which, by their nature, are either dangerous, inaccessible or otherwise incapable of visual recording, and at the Faggs Road, Feltham, works of Epsylon Industries, Ltd., Press representatives were recently given practical demonstrations of this technique.

The opportunity was provided to inspect the Epsylon industrial television system which has been designed with small size, convenience and

reliability as the outstanding considerations, yet with a clarity of definition equal to that used by leading national broadcast companies. The system is designed for reliable operation in severe industrial environments.

The camera is fully automatic, and all d.c. supplies are stabilised to eliminate effects of supply variation. Due to automatic control of signal levels for changes of light level and remote control of electrical functions, it has been possible to avoid the cost of expensive camera cable runs by stowing the camera control unit near the camera head, the normal cable length being 50ft.

The camera control unit is designed for 19in rack mounting and consists of five plug-in sub-units for ease of maintenance, each unit having failure lamps to indicate fault. The units are video, line scan, field scan, stabilising, power and control.

Epsylon Industries television camera head for industrial television use

A range of picture monitors is available specially designed for industrial television use, with a performance as required by the broadcasting authorities. The range includes 8in and 17in picture diagonal versions. Each monitor has basically a similar circuit with modifications to meet the particular cathode ray tube in use and 405, 525 and 625 line specifications are provided for.

Electricity for the Grower

A new book entitled "Electricity for the Grower" was introduced by Mr. J. I. Bernard, director and secretary of the British Electrical Development Association, at a pre-Chelsea Show reception for the Press in London last week. This latest E.D.A. publication of 104 pages explains to the commercial horticulturist the many benefits that can be obtained by the increased use of electricity on his holding. The essential part that electricity plays in modern growing techniques in providing light, heat and power for ensuring the correct environment for plants is fully covered in the book, and, in addition, there are useful chapters on refrigeration, mist propagation, pest control, etc., and one dealing with the electrical installation. Copies of the book, which is well illustrated throughout, may be obtained from Electricity Boards or from the offices of the Association at 2, Savoy Hill, W.C.2.

Motors for Nitrogen Factory

For the water supply at the new nitrogen factory of Fisons, Ltd., at Stanford-le-Hope, six N-S variable-speed a.c. motors, driving Worthington Simpson pumps, have been supplied by Laurence, Scott & Electromotors, Ltd. Three of the motors are each of 315/155 h.p., 1,050/800 r.p.m. and three are of 130/60 h.p., 1,100/800 r.p.m. The motors are controlled by the "Asreo" speed control system and a system of auto-paralleling control which brings in an additional pump when required by the demand, provision being made for adjusting automatically the speed of the leading pump, and of the incoming pump, to meet the new conditions.

Small Digital Computer

A desk-size digital computer using transistors was introduced by Ferranti, Ltd., at the Transistor Exhibition. The computer, called "Sirius," will cost £15,000 and the first production models will be available this autumn. The manufacturing schedule will enable delivery to be made within three months of ordering.

"Sirius" is claimed to be the smallest and most economically priced computer yet made in Europe. It weighs only 5 cwt, measures approximately 7ft by 3½ft by 4ft high, including a standard office desk, and it can be plugged into the ordinary power sockets in any office or laboratory. Its chief application is expected to be statistical analysis in industry, commerce and laboratory where the rapid turn-around of statistical calculations can appreciably speed up the continuity and flow of production work, but it can also perform many other types of jobs. It is also intended for technical colleges for general educational purposes and training of electronic engineers, technicians and physicists. Other suitable applications are for consulting engineers and process control.

The computer is constructed of neuron packages and magneto-striction delay lines. It works in decimals, each decimal digit being represented by four binary digits. Checking is done inside the machine by automatic detection of forbidden combinations. Input and output is on paper tape and a set of 100 buttons, similar to a desk calculator, may be used to operate the machine or put information directly into the main store. Very few buttons need be used for developed programmes. The basic input/output speeds are the same as for the company's larger all-purpose "Pegasus."

Orders for Diesel-Electric Power Units

The British Transport Commission has placed orders for sixteen spare power units, comprising diesel engine and main generator only, for 350 h.p. diesel-electric shunting locomotives. The English Electric Co., Ltd., is to supply fifteen units and the other will be supplied by the General Electric Co., Ltd.

Equipment for Swedish TV Stations

Marconi's Wireless Telegraph Co., Ltd., is to supply the sound and vision transmitters, combining filters and programme input and ancillary equipment, for five new Band III television stations at present under construction in Sweden. These will be at Borlänge, Sundsval, Västeras, Emmaboda and Västervik. The order was placed by the Royal Board of Swedish Telecommunications.

E.A.W. Activities

The E.A.W. Training and Diploma Committee has revised the form of the practical examination for the E.A.W. Diploma for Demonstrators to bring it more into line with the day-to-day work of the demonstrator. The revised examination will consist of the following:—A formal demonstration of

Ferranti "Sirius" desk-size digital computer which uses transistors

cookery, or laundry, or a combination of the two; an extempore demonstration on a connected appliance chosen by the examiners; and a viva voce examination on any aspect of domestic electrical housecraft.

No change will be made until after 30th June next.

A successful one-day conference on the teaching of electrical housecraft was organised on 2nd May in the Carlisle Technical College by the E.A.W. It was attended by fifty-one domestic science teachers from the city of Carlisle and the county of Cumberland. Lectures and demonstrations were given on electrical cooking, electrical laundry equipment, refrigeration and electrical housecraft teaching.

The Nelson Branch of the Association recently celebrated its 21st birthday and the Inverness Branch held its 25th anniversary dinner under the chairmanship of Bailie Mrs. Helen Kennedy.

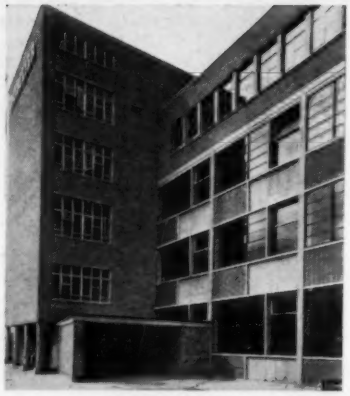
Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Monday last.

ALUMINIUM ingots	ton £180 0s 0d
COPPER, H.C. Electro	ton £240 10s 0d
Fire Refined 99·70%	ton £239 0s 0d
Fire Refined 99·50%	ton £238 0s 0d
COPPER Tubes ..	lb 2s 4d
Sheet	ton £271 10s 0d
H.C. wire and strip ..	ton £288 5s 0d
LEAD, English ..	ton £70 5s 0d
Foreign	ton £69 0s 0d
MERCURY	flask £77 10s 0d
TIN, block (English) ..	ton £785 10s 0d
ZINC, G.O.B. Foreign	ton £78 10s 0d
BRASS Tubes (solid drawn)	lb 1s 10½d
Wire	lb 2s 8½d
PHOSPHOR BRONZE Wire	lb 4s 1½d
PLATINUM	oz £28 10s 0d
RUBBER, No. 1 R.S.S. spot	lb 30½d—30¾d

Dubilier Factory Extension

In 1957 work was commenced on a new building at the Dubilier Condenser Company's Ducon Works in North Acton to accommodate the laboratory and development departments. This building, costing approximately £200,000 and having some 38,400 sq ft of floor area, has now been completed. The laboratories and the development department incorporate separate chemistry, electrolytic capacitor, paper capacitor and general laboratories as well as a constant temperature standards room, a life testing room and a high frequency measurements room. At the top of the four-storey building, which has a passenger and goods lift to all floors, is installed the reactor supplying voltages in the correct phase for testing capacitors, and also the 5,250 gal water tanks which supply the cooling system. The works canteen, with a seating capacity of 526, is housed in the building, and also a recreation room having a fully equipped stage and library. There are also a photographic dark room, prototype drawing office and a pilot manufacturing plant used in the development of new products.



The new building at the Dubilier Condenser Company's North Acton works

Trade Announcements

On 1st June the London district office of **Siemens Edison Swan, Ltd.**, will move to Crown House, Aldwych, W.C.2 (telephone: Temple Bar 8040), and all sales and deliveries for the London area, which will include the Home Counties and the branches at Reading, Maidstone, and Ipswich, will be controlled from that address. The London district office will continue under the management of Mr. J. A. E. Trinder, and sales, service and supply will be under the management of Mr. R. J. Seaman. The stores will remain at Tyssen Street, Dalston, E.8.

Kennion, Irvine & Co., Ltd., have opened offices at 2, Station Street, Glossop, which will cater for the company's activities in the northern half of the country. The offices are under the management of Mr. H. Hargreaves, formerly with Permali, Ltd., and Hordern Richmond, Ltd.

Mr. D. Musk, Graduate I.E.E., has been appointed sales engineer representing the **Bowthorpe Electric Co., Ltd.**, and **Tate Engineers, Ltd.**, in Scotland, the North of England and Northern Ireland. He commences his duties on 1st June.

Henley's Sales Conference

The divisional sales managers of W. T. Henley's Telegraph Works Co., Ltd., and branch managers from all parts of the British Isles met for a sales conference at the Eccleston Hotel, London, S.W.1, on 20th and 21st May under the chairmanship of Mr. H. D. Parsons, general sales manager. Among the matters discussed were the new trading conditions following the cessation of the M.C.M.A. and R.C.M.A. pricing arrangements.

Transport of Energy

We regret that, owing to inadvertence, in the penultimate sentence of our last week's leading article, the words "East Midland stations" and "London Division stations" were transposed. The effect was, of course, the opposite of what the general context was intended to convey.

NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged.

MONDAY, 1st JUNE

Ilford.—Angel Hotel, 7.30 p.m. A.S.E.E. North East London Branch. Annual general meeting.

Leeds.—Great Northern Hotel, 7 p.m. A.S.E.E. Leeds Branch. Annual general meeting.

Sheffield.—Royal Victoria Hotel, 7.15 p.m. A.S.E.E. Sheffield Branch. Annual general meeting.

MONDAY, 1st JUNE to FRIDAY, 5th JUNE

Torquay.—British Electrical Power Convention. (Programme on page 973.)

TUESDAY, 2nd JUNE

Hammersmith.—Windsor Castle Hotel, 134, King Street, 7 p.m. A.S.E.E. West London Branch. Annual general meeting.

Maidstone.—Royal Star Hotel, 7 p.m. A.S.E.E. West Kent Branch. Annual general meeting.

WEDNESDAY, 3rd JUNE

Birmingham.—I.E.S. Birmingham Centre. Summer outing.

Halifax.—Crown Hotel, Horton Street, 7.15 p.m. A.S.E.E. Halifax Branch. Annual general meeting.

Manchester.—Engineers' Club, Albert Square, 6.45 p.m. A.S.E.E. Manchester Branch. Annual general meeting.

International Club, 64, George Street, 1, 6.45 p.m. Women's Engineering Society, Manchester Branch. Annual general meeting followed by film show.

Nottingham. — Mechanics' Institution, Trinity Square, 7.30 p.m. A.S.E.E. Nottingham Branch. Annual general meeting.

Preston.—R.A.F.A. Club, East View, 7.30 p.m. A.S.E.E. Preston Branch. Annual general meeting.

Wood Green.—Town Hall, 7.15 p.m. A.S.E.E. North London Branch. Annual general meeting.

WEDNESDAY, 3rd JUNE to SATURDAY, 6th JUNE

Yeovil.—Bath and West Agricultural Show.

THURSDAY, 4th JUNE

Southampton.—Polygon Hotel, 7 p.m. A.S.E.E. Southampton Branch. Annual general meeting.

FRIDAY, 5th JUNE

Bristol.—Grand Hotel, 7.45 p.m. A.S.E.E. Bristol and West of England Branch. Annual general meeting.

Crewe.—Royal Hotel, 7.30 p.m. A.S.E.E. Stoke and Crewe Branch. Annual general meeting.

Liverpool.—M.A.N.W.E.B., Paradise Street, 7.30 p.m. A.S.E.E. Liverpool and District Branch. Problems night.

NEW ELECTRICAL EQUIPMENT

Induction Heating Equipment

A complete induction furnace designed to serve a 3in to 4in upsetter has been introduced by the Induction Heating Division of GARRINGTONS, LTD., Bromsgrove, Worcs. The machine permits stopping and starting and the rate of production to be controlled by the upsetter machine operator. The machine is magazine fed and is of two-track form suitable for handling a size range of stocks from 8 to 16in long and from $\frac{7}{8}$in to $1\frac{1}{4}$in diameter. The furnace will heat either totally or partially to a forging temperature of 1,250 deg C at a throughput rate of 360 pieces per hour. The maximum output is 500 lb/hr with an input power of 150 kW at 4 kc/s. The source of power is a totally enclosed, water-cooled motor/alternator set which is fully interlocked with the control cabinet and the furnace. Manually switched power factor correction capacitors are incorporated in the equipment and the work coils, which can be supplied to suit a variety of requirements, are water-cooled.

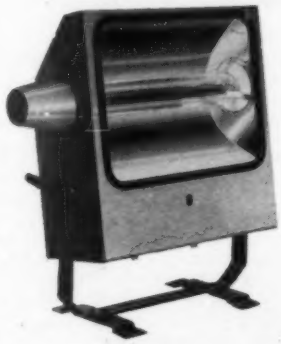
Sodium Floodlight

An inexpensive, completely self-contained floodlight, supplied with the ballast and capacitor secured and wired inside the body, which projects a wide beam and is suitable for the lighting of buildings and large ground areas, has been announced by PHILIPS ELECTRICAL, LTD., Century House, Shaftesbury Avenue, London, W.C.2. Lamp replacement is made simply by removing the lampholder cover, allowing the lamp to be withdrawn without disturbing the front of the fitting.

The body is of welded sheet steel, zinc plated and stove enamelled. The trunnion arm and feet are of galvanised wrought iron. Anodised aluminium is used for the reflector and the toughened sheet glass front is sealed by a rubber strip—no glazing compounds are used.

The fitting is wired to a three-way terminal block above the cable gland with a $\frac{3}{4}$in cable entry. The gear tray can be lowered on four captive screws for easy access to fuse and neutral link. The type R.7780 projector sells at a list price of £28 10s, complete with control gear.

Philips floodlight projector



Nylon Cutter

The "Dee-Gee" electrically heated nylon cutter, now being manufactured by DAVID GRIFFIN, LTD., Wimborne Road, Poole, Dorset, is similar to an instrument soldering iron in shape and size, except that in place of a bit there is a stainless steel blade.

David Griffin "Dee Gee" nylon cutter

The total loading is 30 W and within about 10 minutes the blade will heat sufficiently to enable all kinds of nylon or other man-made fibre materials to be cut with ease. The cutter is held like a pen and only slight pressure is needed. Hemming is not necessary as the cut edges are permanently heat sealed and, in addition, buttonholes can also be cut.

The overall length of the appliance is $7\frac{1}{4}$in. It is suitable for use on 230-250 V supplies and is fitted with a length of three-core flexible. The price is 19s 6d.

Industrial Dehumidifier

An industrial dehumidifier introduced by WESTOOL, LTD., St. Helen's Auckland, County Durham, for use in laboratories, test rooms, strong rooms, document storage spaces, and in the dry storage and processing of hygroscopic materials, has a water extraction of up to one pint per hour and under average conditions it will deal with a space of up to 2,000 cu ft. The water condensed on the cooling coil of the hermetically sealed refrigeration system is collected in a tray with a draining connection, and the air circulated is then reheated to its original temperature and returned to the room. The lowest relative humidity obtainable depends on the ambient temperature: humidities of 35 to 40 per cent can be obtained at 80 deg F, 48 to 50 per cent at 65 deg F and 55 per cent at 55 deg F. With low ambient temperatures frost may occur and the fitting of a time switch providing occasional short de-frosting periods is advisable.

Westool industrial dehumidifier

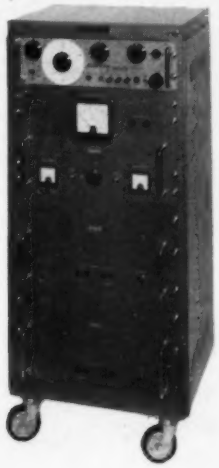
The wiring is carried to an internal terminal block and provision is made for the connection of the unit either by conduit or flexible cable through a grommet in the casing to the external controls. A 6ft length of 3-core cable is supplied with the unit. The compressor of the refrigeration system is coupled to a $\frac{1}{3}$ h.p. motor, both enclosed in a sealed, oil-filled dome with internal anti-vibration mountings, and the aluminium circulating fan is directly coupled to a shaded pole motor. The unit, which has overall dimensions of $15\frac{1}{4}$in by $12\frac{1}{4}$in by $10\frac{1}{2}$in high and weighs 55 lb, is suitable for connection to a 220/240 V 50 c/s single-phase supply, and the power consumption is 250 W. The price is £42 10s.

Low Frequency Amplifier

A very low frequency amplifier for driving l.f. vibration test generators and for similar uses where large outputs at various low frequencies are required has been developed by GRAMPIAN REPRODUCERS, LTD., Hanworth Trading Estate, Feltham, Middlesex. The continuous output power rating is 100 W r.m.s. sine wave at 10 c/s to 5 kc/s, and the output impedance is variable between 10 and 100 Ω, though other impedances can be supplied to specification.

The units are mounted in an enclosed type rack assembly, having approximate dimensions of 2ft by 2ft by 4ft high, mounted on rubber tyred castors to facilitate movement on site. Alternative mountings and assemblies can be arranged to meet specific requirements.

Grampian low frequency amplifier



GENERATION and DEVELOPMENT

C.E.G.B. Contracts

The Central Electricity Generating Board has placed contracts during the past month for power stations, transmission lines and transforming stations amounting in the aggregate to approximately £13,500,000. They include the following:—

Belvedere power station: Structural steelwork, southern portion.—Sir Wm. Arrol & Co.

Northfleet: Booster and boiler feed pumps for Nos. 1, 2 and 3 generating sets.—Sulzer Bros. (London).

West Thurrock: Coal handling plant.—Birtley Engineering. Foundations and culverts.—Richard Costain. 11 kV switchgear, control and relay panels, and accessories.—A. Reyrolle & Co.

Blyth "B": Foundations and civil works.—Sir Robert McAlpine & Sons (North Eastern). Two 275 MW reheat boiler units.—Yarrow & Co.

Skelton Grange "B": Superstructure.—J. L. Kier & Co.

High Marnham: Main lighting, heating and l.v. supplies installation.—B. French.

Ffestiniog: 16 kV circuit-breakers and protective gear.—G.E.C.

Padiham "B": Two natural draught concrete cooling towers.—Mitchell Construction Co.

Chessington substation: Two 120 MVA 275/132 kV transformers.—Hackbridge & Hewittic Electric Co.

Feckenham substation: Two 120 MVA 275/66 kV transformers.—B.T.H. Co.

Boldon substation: Two 120 MVA 275/66 kV transformers.—C. A. Parsons & Co.

Lackenby substation: Two 120 MVA 275/66 kV transformers.—C. A. Parsons.

Hart Moor substation: Two 120 MVA 275/66 kV transformers.—C. A. Parsons.

Plymouth North substation: One 45 MVA 132/33 kV transformer.—G.E.C.

Willenhall substation: 132 kV 3,500 MVA switchgear.—G.E.C.

Fawley North substation: 132 kV 3,500 MVA switchgear.—B.T.H. Co.

Standardisation of London Commercial Tariffs

The London Electricity Board has announced that a standard tariff for supplies of electricity for commercial and miscellaneous purposes is to be introduced throughout its Area as from 30th September next in the case of new consumers and from the first normal meter reading after that date for existing consumers. Under the tariff, which will apply to shops, offices, warehouses, hotels, training establishments, places of amusement, public institutions, places of worship, hospitals, surgeries, nursing homes and similar premises, there will be a choice of three rates—flat, installed load and maximum demand; a catering rate is also included. While some consumers will pay less and others more, it is estimated that on balance the total income from supplies taken under the new tariff will be a little less than it would have been under existing tariffs, which vary in different parts of the Area.

The main details of the various rates under the new tariff are as follows:—

C.1 Installed Load Rate.—Standing charge based on installed load and a running charge of 1¼d/kWh; minimum charge £1 a quarter. Where the Board is satisfied that any supply to a place of worship or associated hall is used only intermittently and for short periods during times of peak load, half the normal standing charge will be payable.

C.2 Flat Rates.—Lighting, 6d/kWh. Supplies through one meter for power, cooking, water heating, space heating or any other approved purpose, 2½d/kWh. Power, 2d/kWh. Cooking or water heating, 1¾d/kWh. Minimum charge 10s per annum.

C.3 Maximum Demand Rate.—Monthly demand charge at the rate of £11 a year for each of the first 20 kW of chargeable demand, reducing to £7 15s/kW over 1,000 kW, and a running charge scale of 0·8d-0·65d/kWh, subject to a fuel price adjustment of 0·00063d/kWh for each penny variation from £3/ton.

C.4 Catering Rate.—1½d/kWh.

Output in April

The monthly statement issued by the Ministry of Power shows that 6·2 per cent more electricity was generated in April than in the corresponding month of last year. This compares with a decline of 3·4 per cent in March, but, as in that month, the comparison is disturbed—in the reverse direction—by the fact that the Easter holidays fell in March this year. Figures for the first four months of the year indicate that the rise in output has been at a lower rate than a year ago (5·4 per cent against 13·8 per cent), although here again another factor must be taken into account—the increasing supplies from the United Kingdom Atomic Energy Authority's nuclear power stations, which are not included in the table. So far this year 287 million kWh has been made available from this source compared with only 126 million kWh in the corresponding period of 1958.

At the end of April plant installed in power stations of the Central Electricity Generating Board, the South of Scotland Electricity Board and the North of Scotland Hydro-Electric Board aggregated 28,267 MW, an increase of 257 MW since the beginning of the year. This included a 120 MW Parsons set and an 860 klb/hr International Combustion boiler commissioned in April at the C.E.G.B.'s Drakelow "B" generating station.

A separate statement of electricity generated by industry (including supplies from the U.K.A.E.A. stations) shows that in the 17 weeks ended 2nd May 3,684 million kWh was generated, 1 per cent more than in the corresponding period of last year. For individual industries the percentage changes were as follows:—Chemicals: Nuclear power stations +127·9; other, +0·8. Iron and steel, −11·1. Engineering, −15·7. Textiles, leather and clothing, −5·8. Food, drink and tobacco, +15·9. Paper, +4·2. Other industries, −1·3.

Sales of Domestic Appliances in 1955-58

Each month the Electricity Council issues details of the sales of the main classes of domestic appliances by Area Boards in England and Wales, the latest of which appeared in the *Electrical Review* of 15th May. It has now published a folder giving a complete record of these figures for the years 1955-58, with graphs illustrating the trend of sales and a note of the various Government Orders relating to hire-purchase and purchase tax which have affected the demand.

ELECTRICITY GENERATED AND PLANT INSTALLED

	Fuel consumed Thousand tons			kWh generated Millions			kWh sent out Millions	Installed capacity (m.c.r.) MW
	Coal	Coke and Breeze	Oil	Steam	Water power	Total		
Central Electricity G.B. ...	3,444	97	308·8	7,776	8	7,788	7,320	25,598
North of Scotland H.E.B. ...	1	—	1·3	1	150	157	156	1,011
South of Scotland E.B.	253	4	0·2	484	25	509	480	1,658
Total for April, 1959	3,698	101	310·3	8,261	183	8,454*	7,956	28,267
Corres. total for April, 1958 ...	3,793	84	146·8	7,819	128	7,960	7,484	26,836
Inc. or dec., per cent	−2·5	+19·8	+111·5	+5·7	+43·4	+6·2	+6·3	+5·3
Total to date (4 months), 1959...	16,886	419	1,373·3	37,334	794	38,179	35,984	
Total for corres. 4 months of 1958	17,496	368	528·1	35,321	826	36,211	34,105	
Inc. or dec., per cent	−3·5	+13·8	+160·1	+5·7	−4·0	+5·4	+5·5	

* The total figure includes generation by other methods amounting to 10 million kWh.

Lectures on Materials Handling

Materials handling problems arise in every branch of manufacturing, transport and warehousing and it is desirable that solutions to these problems should be found by a scientific and informed approach leading to higher labour and capital productivity. To this end the National Joint Committee on Materials Handling, a body on which are represented over twenty professional and kindred societies concerned with various aspects of the subject, feels that it may be able to assist secretaries of societies and other bodies drawing up their programmes for the 1959-60 sessions, by suggesting suitable subjects for lectures and possible lecturers. Further information can be obtained from the Secretary, National Joint Committee on Materials Handling, 69, Cannon Street, London, E.C.4 (telephone: City 4444).

NEW PATENTS Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2

1954

7033. Photo Printed Circuits, Ltd.—Printed resistors and circuits containing them. 10th August, 1955. (Cognate application 14093, 13th May, 1954.) (813821.) 13011. Resistors. 4th August, 1955. (813822.) 24662 and 27573. Electrical components. 23rd August and 23rd December, 1955. (813823/4.)

25530. Gresham Transformers, Ltd., and Planer, Ltd., G. V.—Hermetic sealing of electrical apparatus. 31st August, 1955. (813901.)

25965. Electric & Musical Industries, Ltd.—Thermionic valves and cathodes therefor. 7th September, 1955. (813902.)

1955

6623. Mullard Radio Valve Co., Ltd.—Electron discharge tubes. 14th February, 1956. (813904.)

8029. Postmaster General.—Electromechanical crystal transducer elements exhibiting piezo-electricity or ferro-electricity. 25th May, 1956. (814123.)

12711. National Research Development Corporation.—Electronic image tubes. 30th April, 1956. (814124.)

14236. Schulmerich Electronics, Inc.—Apparatus for producing bell tones. 7th May, 1955. (814088.)

15609. Photo Printed Circuits, Ltd.—Printed resistors. 31st August, 1956. (813825.) 16809. Electrical resistors. 10th August, 1955. (Divided out of 813821.) (813827.)

22856. Smith & Sons (England), Ltd., S.—Wire-wound variable resistors. 29th October, 1956. (814126.)

23084. Landis & Gyr, A.G.—Making transformers. 10th August, 1955. (813985.)

25493. Allmänna Svenska Elektriska A.B.—Means for controlling static convertors in a high voltage d.c. transmission system. 6th September, 1955. (813989.)

25670. Sangamo Weston, Ltd.—Capacitance measuring instruments. 7th September, 1955. (813907.)

27393. Automatic Electric Laboratories, Inc.—Desk telephone. 26th September, 1955. (814089.)

28850. British Insulated Callender's Cables, Ltd.—Electric cable systems and cables, fittings and accessories therefor. 9th October, 1956. (813993.)

30151. Ateliers de Constructions Electriques de Charleroi.—Apparatus for the recording and reproduction of sound at a distance. 21st October, 1955. (814129.)

30214. British Insulated Callender's Cables, Ltd., and British Ropes, Ltd.—Construction of overhead electric traction systems. 19th October, 1956. (814130.)

30628. Stone & Co. (Deptford), Ltd., J.—Electromagnetic carbon pile regulators. 22nd October, 1956. (814090.)

32408. Egen Electric, Ltd., and Hook, J. R. R.—Potentiometers for use in radio circuits or the like. 12th November, 1956. (813995.)

33299. General Electric Co., Ltd.—Electric motor control systems. 20th November, 1956. (813837.)

37268. General Electric Co.—Electron discharge devices. 29th December, 1955. (813840.)

1956

5528. Bendix Aviation Co.—Magnetic electron multiplier. 22nd February, 1956. (Addition to 811452.) (814134.)

7330. Soc. d'Electronique et d'Automatisme.—Method and means for measuring phase shifts of electric signals. 8th March, 1956. (814137.)

7967. Rank Cintel, Ltd.—Electric signal generators. 13th March, 1957. (814138.)

10246. Union Carbide Corporation.—Primary galvanic cells containing multi-layer separator films. 4th April, 1956. (813846.)

12402. Varian Associates.—Gyromagnetic resonance apparatus. 23rd April, 1956. (814098.)

13789. Dayonnet, F. J. D., and Gloess, P. F. M.—System of electronic telephonic switching by pulses. 4th May, 1956. (814099.)

15106. Western Electric Co., Inc.—Wave modulating and demodulating circuits. 15th May, 1956. (813851.)

15149. Siemens & Halske A.G.—Band-stop electric wave filters. 15th May, 1956. (813852.)

18433. Sperry Rand Corporation.—Magnetic amplifier power supply arrangements. 14th June, 1956. (813853.)

19415. Standard Telephones & Cables, Ltd.—Telephone ringing equipment. 21st June, 1957. (814141.)

27295. Scholes & Co., Ltd., G. H., Pearce, F. J., and Pearce, G. S.—Two-way electric switching circuits. 8th July, 1957. (813932.)

27462. Svenska Aktiebolaget Gas-Accumulator.—Course indicating radio beacons. 7th September, 1956. (813858.)

29384. Marconi's Wireless Telegraph Co., Ltd.—Aerial systems. 27th June, 1957. (813934.)

29477. Automatic Telephone & Electric Co., Ltd.—Ringing arrangements for telephone systems. 30th August, 1957. (813935.)

30560. Crossland, Ltd., R. & A. G.—Industrial electric lighting fittings. 2nd October, 1957. (814023.)

30839. Kolster-Brandes, Ltd.—Transistor amplifiers. 4th October, 1957. (813859.)

31153. Western Electric Co., Inc.—Transistor circuits. 12th October, 1956. (813860.)

32341. Leece-Neville Co.—Electric motor construction. 23rd October, 1956. (814145.)

32635. Cole, Ltd., E. K., and Reeves, R. J. D.—Electric current step generators for use in electronic circuits. 28th October, 1957. (813936.)

32878. Erie Resistor Corporation.—Electrical network assembly. 29th October, 1956. (814146.)

1957

3942. Bristol Co.—Electromagnetic switching control devices. 5th February, 1957. (813946.)

5539. Union Carbide Corporation.—Electric dry cells. 19th February, 1957. (814043.)

6867. Standard Telephones & Cables, Ltd.—Radio communication system. 1st March, 1957. (814114.) 6868. Electrical switching circuits employing transistors. 1st March, 1957. (814115.)

7231. Apra Precipitator Corporation.—Flashover elimination in electrostatic precipitators. 5th March, 1957. (814044.)

10484. Rotili, C.—Electric dry cells. 1st April, 1957. (814048.)

13369. Standard Telephones & Cables, Ltd.—Circuit arrangement for the storing of calls in automatic telecommunication exchanges. 26th April, 1957. (814118.)

14495. Amp, Inc.—Electrical connection between a conductor and the braided conductor of a shielded cable. 7th May, 1957. (814050.)

16215. Standard Telephones & Cables, Ltd.—Electric wave filters. 22nd May, 1957. (813962.)

16216. Allmänna Svenska Elektriska A.B.—Pole system for a low powered a.c. motor. 22nd May, 1957. (814052.)

16722. General Electric Co.—Apparatus for translating a multi-co-ordinate display into binary information. 27th May, 1957. (814053.)

16872. Compagnie Générale de Télégraphie sans Fil.—Delay lines for use in travelling wave tubes. 28th May, 1957. (814126.)

18021. Schweitzer, H. E.—Electric push-button switch means. 6th June, 1957. (813965.)

19130. Standard Telephones & Cables, Ltd.—Arrangement for measuring the duration of electric pulses. 18th June, 1957. (813967.)

19579. Standard Telephones & Cables, Ltd.—Device for transferring code signals from a tape to a register and a convertor using such a device. 21st June, 1957. (813886.)

21009. Culk, R.—Compressor for refrigeration, with an electric motor horizontally flanged thereto. 3rd July, 1957. (814156.)

22155. Standard Telephones & Cables, Ltd.—Multiplex transmission systems. 12th July, 1957. (814158.)

27608. Leece-Neville Co.—Electric retractive switch. 2nd September, 1957. (814058.)

28912. Creed & Co., Ltd.—Electrical printer mechanism. 13th September, 1957. (814060.)

29513. Bristol Co.—Control systems for electric motors. 19th September, 1957. (814061.)

29687. Collins Radio Co.—Control systems for selectively positioning electric motor-driven loads. 20th September, 1957. (813974.)

33871. General Motors Corporation.—Electric lamp sockets and printed circuit panel assemblies. 30th October, 1957. (813978.)

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 20th June:—

Vista-Tone. No. 781,589. Class 9. Radio sets (sold complete), gramophones, record players, apparatus for recording sound by means of magnetic tape, radio-gramophones, and parts.—Andrew Merryfield, Ltd., Dublin. Address for service, c/o Mathys & Squire, 52, Chancery Lane, London, W.C.2.

Readibat. No. 784,836. Class 9. Batteries and accumulators.—Challenge Cycle & Motor Co., Ltd., Lark Hill Road, Worcester.

Swan Brand (design). No. 783,643. Class 9. Electrical apparatus and instruments and parts.—Bulpitt & Sons, Ltd., St. George's Works, Icknield Street, Birmingham, 18.

Hooverette. No. 785,706. Class 9. Suction cleaning machines, carpet cleaning machines, and parts; cooking utensils, flat irons, percolators, door bells and chimes, burglar alarms, vacuum chimney-sweeping apparatus, door and window opening apparatus; and carpet shampooing machines, floor polishing, floor waxing and floor scrubbing machines (all for domestic use); all being electrically operated.—Hoover, Ltd., Perivale, Greenford, Middx.

Wempress. No. 786,307. Class 9. Parts and fittings for electrical installations.—Wandsworth Electrical Manufacturing Co., Ltd., Albert Drive, Sheerwater, Woking, Surrey.

Jupiter. No. 786,308. Class 11. Electric lighting fittings, floor standard lamps and lampshades.—D. H. Chalet, M. G. Edwards, W. H. Edwards and F. C. Jenkins, trading as Jupiter Lighting, Archel Studio, Archel Road, Fulham, London, W.14.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Armagh.—County Education Committee. 18th June. Electrical installation in a new county school and school meals kitchen at Mountnorris. County architect, 9, Beresford Row, The Mall, Armagh, Northern Ireland.

Australia.—Postmaster-General's Department, Melbourne. 7th July. Ringing generators. (E.S.B. 11716/59. Ten/39158.)*

Contract Board, Melbourne. 8th July. Radar cyclone warning system. (E.S.B. 11871/59. Ten/39193.)*

Belfast.—Northern Ireland Ministry of Finance. 10th June. Electrical installation in new extension to the Henry Garrett Building, Stranmillis Training College. Documents from Room 103, Law Courts Building.

Belgian Congo.—Government General, Leopoldville. 26th June. Construction of a radio broadcasting station at Leo Ndjili. (E.S.B. 11869/59. Ten/39141.)*

Brighton.—Corporation. 8th August. Electrically driven submersible well pumps and booster pumps. (See this issue.)

Chelmsford.—Borough Council. 25th June. Centrifugal pumps (Contract No. 10); reciprocating sludge pumps (Contract 11); dual fuel engines, alternators and control gear (Contract 14). E. P. Allen, borough engineer, Municipal Offices, Coval Lane.

Dagenham.—Borough Council. 6th June. Electrical installations in 79 dwellings at Beamway. Borough engineer, Civic Centre.

Down.—County Education Committee. 4th June. Electrical installation in Annalong (New) Further Education Centre. J. R. W. Murland, consulting engineer, 13, Wellington Place, Belfast.

Edinburgh.—North of Scotland Hydro-Electric Board. Electrical services installation at Tealing substation. (See this issue.)

Ellesmere Port.—Corporation. 28th June. Group "A" street lighting equipment. (See this issue.)

Harrow.—Borough Council. 9th June. Equipment for Group "B" lighting of certain roads. Borough engineer, Council Offices, 48, Uxbridge Road, Stanmore, Middx.

Havant and Waterloo.—U.D.C. 13th June. Electric cable and fittings (Schedule 14) for the year ending 31st July, 1960. Engineer and surveyor, 1, Park Road North, Havant, Hants.

India.—India Supply Mission. 25th June. Power, control and lighting cables for railway electrification required by Damodar Valley Corporation, Calcutta. (E.S.B. 10415/59/I.C.A. Ten/39125.)* 30th June. 132 kV and 25 kV instrument transformers for power supply to railways required by Damodar Valley Corporation. (E.S.B. 10414/59/I.C.A. Ten/39132.)*

India Store Department. 29th June. 250 V and 660 V cables. (See this issue.)

Korea.—Government Office of Supply, Seoul. 9th June. Supply of 944 toggle switches and ten 30 kVA oil-filled transformers. (E.S.B. 12292/59/I.C.A. Ten/39257.)* 11th June. Thirty-eight coupled diesel engine driven a.c. generators with spare parts, varying from 5 kVA to 100 kVA. (E.S.B. 11892/59/I.C.A. Ten/39130.)* 17th June. Telegraph and telephone apparatus. (E.S.B. 11935/59/I.C.A. Ten/39186.)*

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

Malaya.—Central Electricity Board. 18th September. Supply and erection of approximately 100 route miles of 132 kV transmission lines. (E.S.B. 12066/59. Ten/39173.)*

Nottingham.—Water Department. 31st August. Centrifugal borehole and booster pumps, electric motors, switchgear, and diesel engine alternator at Markham Clinton pumping station. B. W. Davies, engineer and general manager, Water Department, Castle Boulevard.

Rhodesia and Nyasaland.—Federal Tender Board, Causeway. 5th June. Twenty 24 V, 2 A d.c. transformer rectifier units for telecommunications services. (E.S.B. 12131/59. Ten/39236.)*

South Africa.—Durban Corporation Telephone Department. 19th June. Telephone equipment. (E.S.B. 12016/59. Ten/39162.)*

Stirling.—County Council. Equipment for trunk road A.80 lighting. (See this issue.)

Vietnam.—Central Purchasing Authority, Saigon. 24th June. Telephone exchanges. (E.S.B. 12301/59/I.C.A. Ten/39266.)*

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Aldershot. — R.C. secondary school (£140,000); Geo. Kemp, Stroud & Co., Ltd., Elms Road.

Alton.—Dwellings (73), Manor estate; Gregory Housing, Ltd., 21, Farncombe Road, Worthing.

Banstead.—Central and branch libraries; county architect, County Hall, Kingston-on-Thames.

Birmingham.—New reference and central library in Edmund Street (£1,250,000); A. G. Sheppard Fidler, city architect, Civic Centre.

Blaydon (Co. Durham).—Police station and courthouse for Durham C.C. (£45,000); M. S. Failes, Ltd., contractors, 199, Coatsworth Road, Gateshead.

Cambridge.—Additional buildings for Queen's College; Basil Spence & Partners, architects, 48, Queen Anne Street, London, W.1.

Carlisle.—Laundry, Durranhill estate, for Initial Services, Ltd.; John Laing & Sons, contractors, Dalston Road.

Chester.—Houses, flats and bungalows (150), Plas Newton estate; city engineer, 49, Northgate Street.

Colnbrook.—Works extensions; Copperad, Ltd., Copperad Works.

Dedworth (Berks.).—Home for old people (£55,360); county architect, Wilton House, Parkside Road, Reading.

Dudley.—Old people's homes on sites at Watson's Green Road and Dudley Wood Road; borough architect, 5, Ednam Road.

Exeter.—Rebuilding and extension of City Library; city architect.

Felling.—Houses (150); J. H. Fisher & Co., Ltd., builders, 12, Lansdowne Terrace, Newcastle-on-Tyne.

Haslemere.—Secondary school; Riley & Wishaw, Ltd., Petworth Road.

Langley Park.—R.C. church, hall and presbytery; A. Rossi, architect, 15, Melbourne Street, Consett.

Llanelly.—Three-storey shops and offices, in connection with scheme for arcade entrance to the Market; borough architect, 5, Goring Road.

London. — Welsh Presbyterian Church, Viscount Street and Fann Street, E.C.; Caroe & Partners, architects, 16, Great College Street, S.W.1.

Luton.—Factories, Cradock Road; Ronald Lyon (Estates), Ltd., Hersham, Walton-on-Thames.

Richmond Hill School and Lewsey Secondary and Junior Schools; Token Construction Co., Ltd., 68, Mount Street, London, W.1.

Maidstone.—College of Art, Waterside; E. T. Ashley Smith, county architect, Springfield, Maidstone.

Manchester.—Refectory and residential buildings for University; J. Gerrard & Sons, Ltd., Swinton.

Middlesbrough.—Works developments for W. Richards & Sons, Ltd., Britannia Foundry, North Ormesby Road.

Morley.—Houses and bungalows (80), Moorhead estate; borough engineer, Town Hall.

Newcastle-on-Tyne. — Proposed new Rutherford College of Technology (fourth stage); city architect, 18, Cloth Market, Newcastle-on-Tyne.

Motor showrooms at 452-475, Westgate Road, for Murray & Charleton, Ltd.; R. Turley & Associates, architects, 46, Jesmond Road, Newcastle.

Northampton.—Two 12-storey blocks of flats in connection with central area development; borough architect.

Northern Ireland.—New technical school, Newtownards; Henry Lynn, architect, 110/111, Scottish Provident Buildings, Belfast.

Nottingham.—Office block, Trent Bridge; John Dudding & Partners, architects, 30, Clarendon Street.

Oxhey.—Flats (90), Oxhey Place; D. C. Denton Smith & Partners, architects, 40, Regent Street, Cambridge.

Peterborough.—Extensions at Cromwell Road School (£21,950), and St. Mark's School (£19,800); Joint Education Board, Bridge Street.

Extensions to Technical College (£26,484); Bernard Stokeley, Ltd., Eastfield Road.

Plymouth.—Showrooms, offices and warehouse; J. H. & W. Reynolds, Ltd., 95, Tavistock Road.

Prudhoe.—Houses (52), West Wylam; J. M. Angus, architect, 3, Gallowgate, Newcastle-on-Tyne.

Radlett (Herts.).—Flats (69), Aldenham Lodge site; clerk to Watford R.D.C., Wynward House, Langley Road, Watford.

Ramsgate.—Kitchen block of St. Lawrence College; Stanley H. Page, architect, 25, Chapel Place.

Skipton.—New works; Varley (Skipton), Ltd., Providence Place.

Smethwick.—Flats (217); W. J. Whittall & Son, Ltd., builders, Lancaster Street, Aston Cross, Birmingham, 4.

South Shields.—Factory extensions, Simonside estate, for Elsy & Gibbons, Ltd.; Page, Son & Hill, 75, King Street, South Shields.

Houses (243) and five shops at Tyne Dock; J. H. Fisher & Co. (Newcastle), Ltd., contractors, 12, Lansdowne Terrace, Gosforth.

Spalding.—Houses (60); U.D.C. surveyor, Spalding, Lincs.

Uttoxeter.—Houses (43), Abbots Bromley; surveyor, Hollydene, High Street, Uttoxeter, Staffs.

Wallington.—Science laboratories and new kitchen at County Boys' School (£45,606); county architect, County Hall, Kingston-on-Thames.

Werrington.—New county primary school in Orchard Lane for Peterborough Joint Education Board; Board's architect, Bridge Street, Peterborough.